RADIO, TELEVISION and HOBBIES

Volume 23, Number 9 **December, 1961**

OUTLOOK BRIGHTER

FACING Christmas, just twelve months ago, I had something to say about the prevailing shortage of technical personnel and the danger of young men seeking to enter the field of electronics, without simultaneously undertaking a proper course of training. Little did I realise that those words were to be given point, within a few weeks, by one of the biggest slumps the industry had known; that, by April, we would be talking about recession and unemployment.

In fact, 1961 has proved to be a very critical year, which has not only taken its toll of many small radio and television concerns, but which has had a profound impact upon the thinking of the larger firms. Many have survived only by a drastic slashing of staff and other emergency measures.

Fortunately, there is evidence enough to suggest that the worst is behind us and that the productivity curve will begin to climb from here on. Merchandise is moving again and assembly lines are getting under way slowly but surely. One senses an air of optimism and a refreshing urge to get out from under the shadow of recession.

One thing is certain: The dark days of mid-1961 represented a lamentable but temporary setback. As a science, electronics can only continue to expand, as it penetrates ever more deeply into every branch and phase of industry. Young people now leaving school can enter this fascinating world with confidence—provided they do so on the firm foundation of approved technical training. Above all, it is essential to beware of "short cuts." These days there aren't any!

As a journal, "Radio, Television and Hobbies" has gone from strength to strength in 1961, making new friends in the process. We hope to make quite a few more with our continuing sponsorship of the "Citizens' Band" (or whatever it should be called) and our current entry into the field of electronic organs.

So, to our friends, old and new, and on behalf of the staff of "Radio, Television and Hobbies," may I express appropriate seasonal greetings and the hope for a brighter and more successful 1962.

W. N. Williams

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Cover Picture:

Watched by a mountain guide (right) two Boeing engineers, Henry Opman (on ladder) and Roger Gillette endeavour to simulate sunlight in space conditions 5,500 ft up on Mt Rainier, U.S.A. The aim is to find the most efficient way to use sunlight as a source of power in satellites and space vehicles, and the high altitude is necessary to provide the clearest possible atmospheric conditions. (See story page 14).

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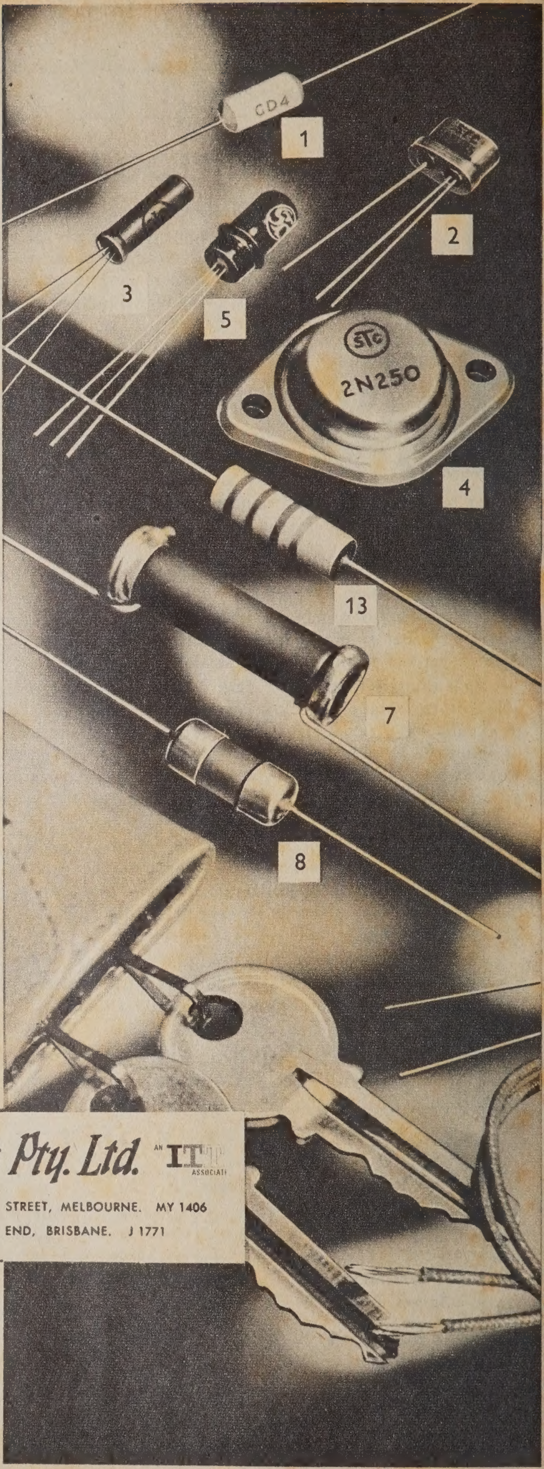

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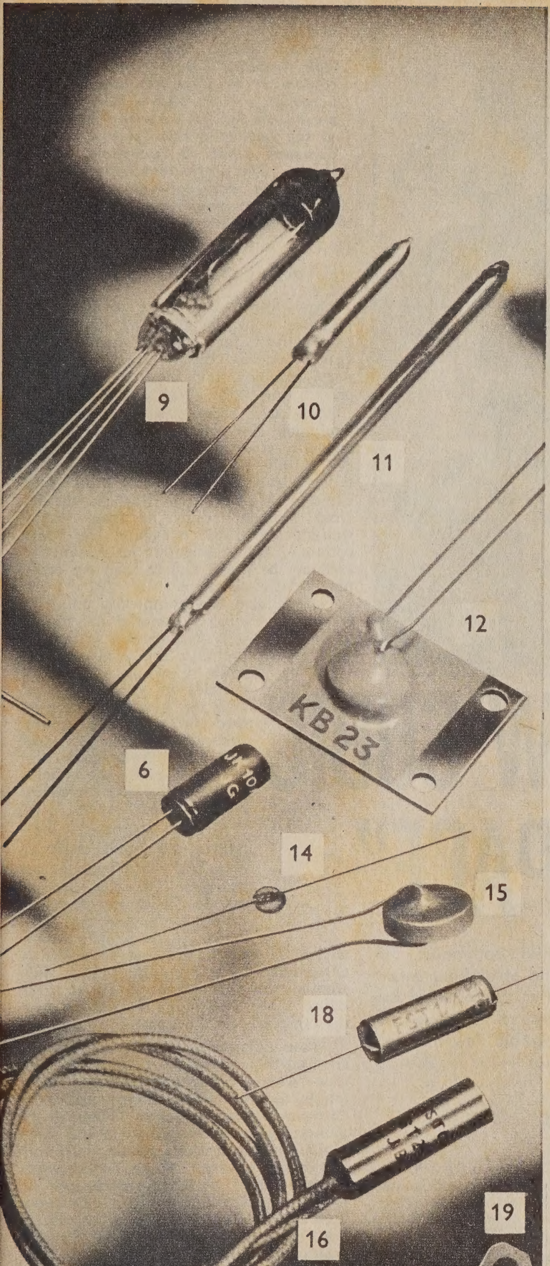

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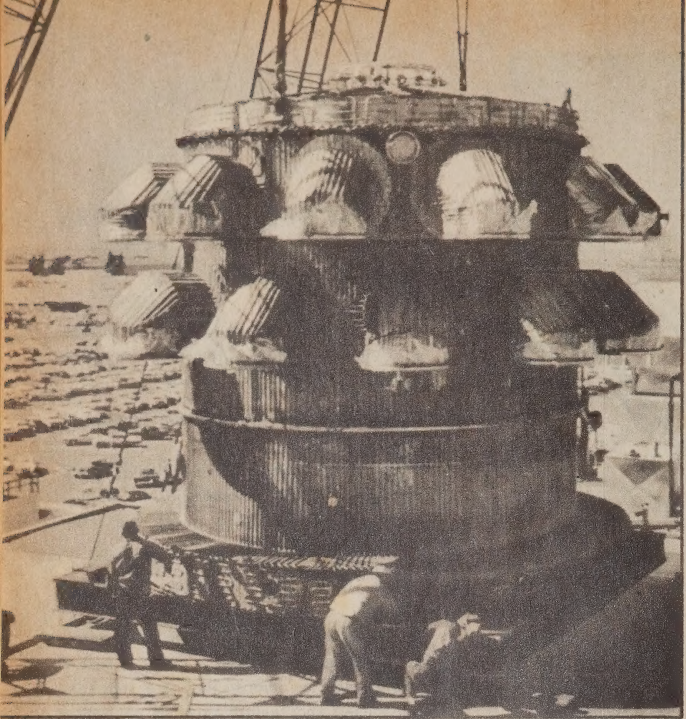


Weird enough to look like a space fiction "prop," this 55-ton, 20ft-high structure is a very real piece of equipment for research and testing purposes. It is shown here being placed on top of a special building at the Lockheed Missiles and Space Company plant at Sunnyvale, California. The protrusions near the top are ducts for connection to the vacuum pumping equipment

Wanted - A FEW CUBIC FEET OF "SPACE"

In the vastness of the universe the most plentiful commodity is space, starting a few score miles above our heads and stretching away in all directions through billions of light-years to infinity. Surrounded by this immensity, inquisitive man is yet compelled to expend thousands of man-hours and millions of dollars to obtain a reasonable facsimile of outer space in quantities of a few cubic yards—or feet —for his use on earth.

By Kenyon Kilbon

THE paradox is an inevitable result of our new-found ability to catapult machines into space before we have developed a reliable method for bringing them back for study and repair. So, because the construction and launching of satellites and space vehicles involves so much effort and expense, there must be some assurance in advance that they will function properly for a reasonable time in the harsh environment beyond the earth's atmosphere.

The answer today is to bring down within our reach some space in which spacecraft may be tested before they are launched. This is a task, which, at first glance, resembles the legendary problem of Mahomet with the mountain. In this case, however, the mountain is moving. Bits of outer space are becoming available on earth through simulation of known space environmental conditions with the aid of increasingly elaborate and specialised equipment in laboratories across America.

In tanks, chambers, and spheres of assorted sizes and uniform ingenuity, space engineers may now study the performance of their handiwork in reasonable approximations of the awesome vacuum, extremes of temperature, damaging radiation, and gravitational and magnetic forces that influence the strange devices which man is hurling outward from his small planet.

Through the first few years of the Space Age, such environmental testing has been performed with relatively small-scale and frequently improvised apparatus suited to the relatively small-scale objects that have been sent into space.

Now, however, a more advanced era impends. In the planning and initial development stage are new satellites and space vehicles considerably larger and more complex than those of the recent past. Many will weigh a ton or more.

Most will carry new and advanced equipment for specialised tasks: telescopes to study the heavens from beyond the earth's disturbing atmosphere; multiple television and electrostatic tape cameras to study the world's weather from vantage points in space; relay stations for global television and radio communications; scientific instruments to land on the moon and to scan the other planets at close range.

Greater size and complexity entail in each case a more substantial investment of time, ingenuity, and money, so that an even greater premium is placed upon reliable operation of the new vehicles in space. Hence, with the new generation of spacecraft is coming a new generation of large, specialised environmental test centres to prove the systems before they soar irretrievably into the heavens.

Already, these new centres are taking shape in the key locations across America. The sites so far include California, Pennsylvania, Tennessee and New Jersey. More will follow within the decade, backing up a swiftly expanding space program with a substantial new technology aimed at simulating space conditions before the eyes of engineers on the ground.

These environmental laboratories will have certain impressive features in common—king-size vacuum chambers, large temperature-humidity rooms, and ponderous vibration machines. One of the pioneering examples, typical of the breed in its general features, is the multi-million-dollar Advanced Space Environment Centre now under construction at RCA's Astro-Electronics Division, Princeton, New Jersey, under the direction of the Major Defence Systems group of RCA Defence Electronic Products.

Upon its completion late this year, the new RCA centre will be the largest such facility in the electronics industry, and the second largest anywhere in the nation.

Construction of the RCA centre began in an appropriately Space-Age fashion on March 23 with a small ground-breaking charge triggered by a signal from the Tiros II weather satellite, which was designed and built for the National Aeronautics and Space Administration at the adjoining facilities of the RCA Astro-Electronics Division.

The signal was received through the division's tracking antenna as the satellite passed within range on its 1,763rd orbital trip around the world. The day also marked the completion by Tiros II of four months of successful operation in space—a full month beyond its anticipated operating life.

Built into the structure rising on the site of the novel ground-breaking are some of the most advanced concepts of environmental testing for space.

The most conspicuous feature, housed in a vast room equivalent in height to an eight-storey building, is a large vacuum-thermal chamber designed to accommodate completely assembled satellites and space vehicles now in the planning stage, and to subject them therein to a cruel range of environmental conditions through days or weeks of operation.

HUGE CONTAINER

Developed by RCA Electron Tube Division engineers at Lancaster, Pennsylvania, the system outwardly resembles a gargantuan pressure-cooker—but one which functions in reverse.

Looming 32 feet above floor level, with a diameter of 29 feet, the chamber receives and disgorges the space payloads through a top opening provided with a removable lid. The operation of the chamber is fully automatic, controlled from a central console in accordance with a pre-programmed sequence of test conditions.

When the vehicle is lowered into the chamber by an overhead crane, the lid seals automatically into place and powerful pumps lower the pressure within the chamber to the equivalent of the vacuum existing several hundred miles out in space—about one thousand-millionth of the normal atmospheric pressure at the earth's surface.

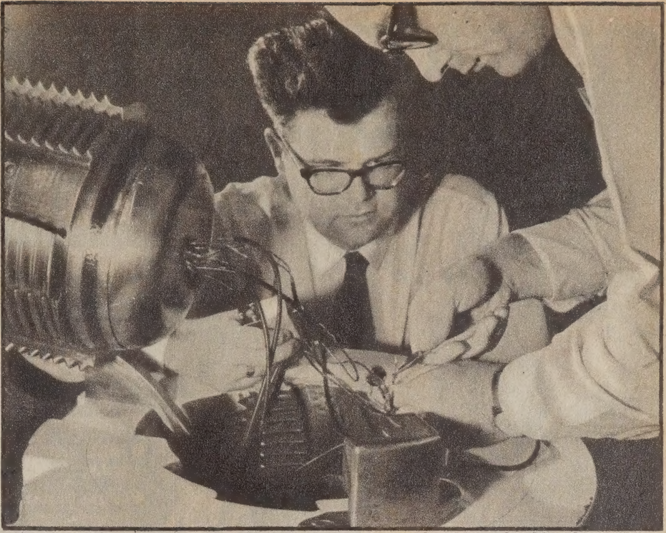
While the spacecraft experiences the vacuum, thermal systems within the chamber may alternately freeze and bake it by exposure to temperatures ranging from 100 degrees F below zero to 250 degrees F above. Throughout the process, instruments outside the chamber record the performance of the devices and sub-systems that comprise the satellite or space vehicle.

At the completion of its ordeal in the chamber, the payload is retrieved through the top opening and lowered to the high-bay area adjacent to the vacuum tank. Here it is inspected — or resuscitated, if necessary—and readied either for shipment to the launching site or for any further tests that may be required.

The trial by vacuum is the most spectacular phase of pre-flight testing, but it is only part of the story. Before any space payload breaks free from the earth's atmosphere, it runs a strenuous course strewn with numerous hazards that can cause failure in almost any part of the system.

It is exposed to dampness during a wait of days or even weeks at a sea coast launching site in Florida or California before it soars aloft on its mission.

Propelled upward in the nose of a rocket, it takes heavy punishment from acceleration and shaking before it is finally separated from the launching vehicle in the relative calm of space.

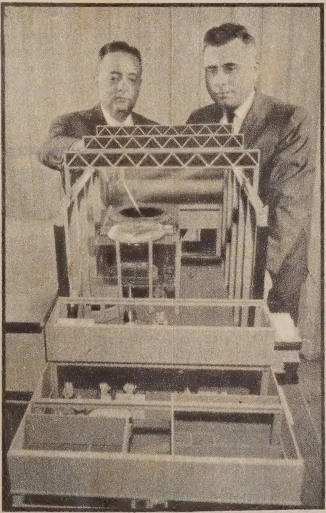


At the other extreme of environmental testing, these two Lockheed scientists are setting up a pressure chamber test using—of all things—a converted Army howitzer.

The new generation of environmental test centres are being elaborately equipped to determine the effect of these hazards upon the more complex and larger space vehicles now on the way.

At the new RCA installation, for example, the need is being met by a large thermal-humidity chamber and an extensive vibration system, both designed to handle entire vehicles as well as their individual components and sub-systems.

In the thermal-humidity chamber, test operations can be run in any type of environment from Arctic temperatures and desert dryness to a steamy 95 per cent humidity and extreme 250 degrees F heat. The vibration system, resembling an outsize kettle drum, supports the vehicle on its flat upper surface for vibration with a 14-ton peak force at frequencies ranging from 5 to 2,000 cycles per second.



Barton Kreuzer (left) and Sidney Sternberg of RCA's Astro-Electronics Division examine a scale model of the Space Environment Centre under construction near Princeton, N.J.

Into the new RCA centre also will be moved an array of environmental test equipment already employed by engineers of the Astro-Electronics Division in the Tiros I and Tiros II programs as well as other space projects.

Among these are a smaller vacuum chamber, shock and vibration machines of assorted sizes, and magnetic field simulators to determine the effect on space systems of the magnetic fields surrounding the earth and other bodies in space.

Upon its completion this year, the new centre at Princeton will be the focal point of an environmental testing program which extends to other parts of RCA's Defence Electronic Products division and includes further existing test facilities that will aid in the space program.

EXTENSIVE FACILITIES

Installed at engineering centres in Camden and Moorestown, New Jersey, these comprise large stratospheric chambers, extensive vibration systems, and shock and impact devices designed primarily to prove the ruggedness of missile and airborne systems operating at or near the boundaries of outer space.

The importance of such facilities as these in the advancing space program is emphasised by their multiplication across the U.S.A. under both governmental and private industry sponsorship.

Ranking high in the government program, for example, is the Mark I Aerospace Environmental Chamber being erected with RCA help at the Arnold Engineering and Development Centre of the U.S. Air Force at Tullahoma, Tennesee, to accommodate large spacecraft for future Air Force programs.

When completed, the Mark I's chamber will accept a satellite up to 65 feet

(Continued on Page 39)

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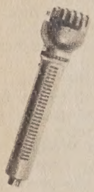

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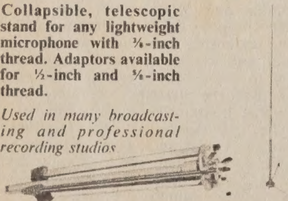

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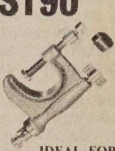

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Industry Has A Stake In TECHNICAL EDUCATION

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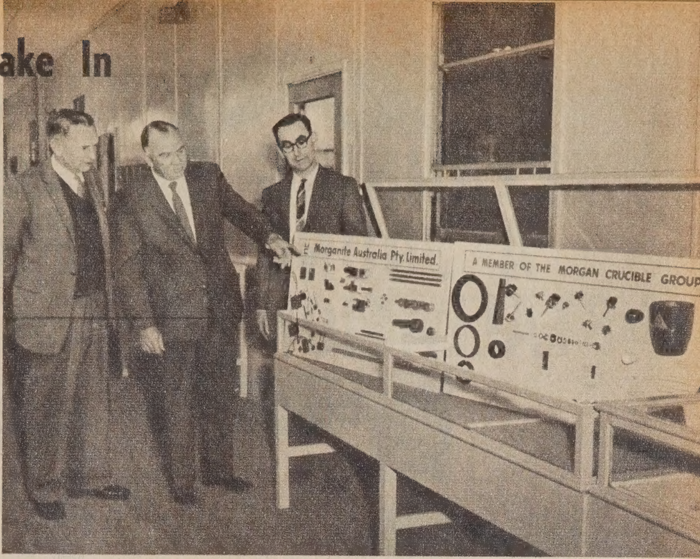

One of the displays presented to the Randwick Boy's High School. From left to right: Mr A. E. Johnstone, Headmaster; Mr R. Ogilvy, Sales Manager, Morganite Australia Pty. Ltd.; Mr M. Kahn, B.A., B.Sc., Senior Science Master.

TYPICAL of what can be accomplished by co-operation of industry, school authorities and parents, is the 1,000 square feet of display recently installed at the Boys' High School, Randwick, N.S.W.

The idea of the display was originated in 1958 by Mr Kahn, B.A., B.Sc., Senior Science Master of the School, with a view to furthering the visual science education of students.

Headmaster A. E. Johnstone, B.A., was quick to see the advantages of the scheme and gave Mr Kahn every assistance in its development. The school's Parents and Citizens' Association also gave it wholehearted support and immediately granted the sum of £50, with the promise of an annual contribution of the same amount.

Mr Kahn approached numerous Australian manufacturers and was delighted with the enthusiastic response he received from many organisations. Some companies sent donations of money and others supplied exhibits.

From the Government Stores, Mr Kahn obtained a large number of old glass-topped and fronted museum display cases and in his spare time repaired and repainted them a cheerful blue. The cases were then placed along the whole of one side of an external corridor and a side corridor where there was excellent natural lighting.

The P. and C. donations also enabled the school's science department to purchase additional supplies of beakers, test tubes and other scientific apparatus.

In an address to the Science Teacher's Association which visited the school to inspect the display on October 23, Mr Kahn listed the firms who had supported the scheme and traced its development.

"Each year supplies are built up and it will not be many years before almost every article, such as hygrometers and co-efficient expansion apparatus, will be present in sufficient quantity for each group of students to perform the one experiment at the one time," Mr Kahn said.

Morganite Australia

Practical assistance for the Sydney Technical College. Mr T. Keane, Headmaster (right), accepts a carton of resistors for use in the Industrial Electronics School.

Among the firms who contributed substantial sums are General Motors-Holdens Pty. Limited, Blundell Spence and Co. Limited, Reichold Chemicals Inc. Aust. Pty. Limited, Australian Glass Manufacturers and Co. Pty. Limited, while the following firms contributed exhibits:

Austral Bronze Limited: Complete display of bronzes, brasses and aluminium alloys, plus metal stampings.
Australian Paper Mills: Model of paper mills.
Brolite Pty. Limited: Complete exhibit of products.
Burroughs Wellcome Pty. Limited: Two balances.
C.I.G. Limited: One balance.
Davis Kent Limited: Detailed construction of water meter.
Dunlop Rubber Co. Limited: Complete exhibit.
Email Limited: Complete display of electrical meters.
E.M.I. Limited: Complete display illustrating the manufacture of gramophone records, including a modern long-playing record.
Eveready: Balance, water bath and plans showing production of certain dry cells.
Gilbert Barker Mfg. Co. (Aust.) Ltd.: Complete exhibit and case for same.
I.C.I. Limited: Chemicals and glassware.
James N. Kirby Pty. Limited: Pyrometer and working model of refrigerator compressor.
Morganite Australia Pty. Limited: Complete display of crucibles, carbon products and electrical and electronic components.
Permanent Magnets Limited: Magnetic separator.
H. C. Sleigh Limited: A pH meter.
S.T.C. Pty. Limited: Transmission valve components.
Stromberg Carlson (A'asia) Pty. Ltd.: Radio parts.
W. D. and H. O. Wills (Aust.) Limited: Distilled water plant and an early model adding machine.

Other firms have promised exhibits.

An impressive outcome of the scheme is the number of companies who have stated their willingness to interview leaving year students seeking employment.

Both Mr Johnstone and Mr Kahn have received congratulations from parents, fellow teachers and manufacturers alike on the success of the scheme.

Mr Kahn was organiser of the "New Deal for School Science Conference," which was opened at Randwick Boys' High School on November 25 by Alderman Jensen, Lord Mayor of Sydney. The principal speaker was Professor Marcus Oliphant, of Canberra University, the conference was attended by representatives of the University of N.S.W., Sydney University, trade unions, parents and citizens' association, National Council of Women, industrial leaders and the general public.

Purpose of the conference was to seek improved conditions and facilities for science education for school children throughout New South Wales.

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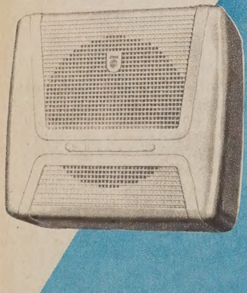

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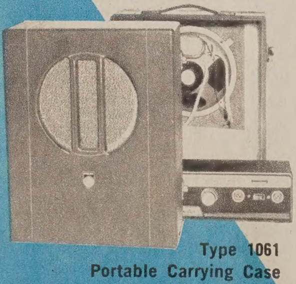

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IN SOUND EQUIPMENT ... *be sure it's a* PHILIPS

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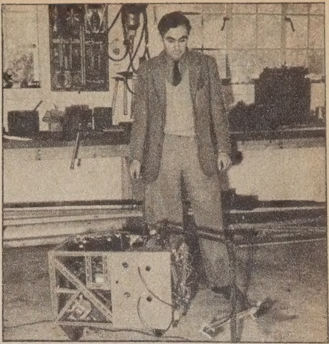
DRIVERLESS VEHICLES FOR FACTORY AND FARM

Electronic control of driverless vehicles is no longer a mere possibility. Experience in England has indicated the possibilities of driverless vehicles in both industrial and agricultural situations and showed the way to their wider use.

By P. A. C. Brockington, A.M.I. Mech. E.



Designed by Mr V. M. Owen, of the Electrical Research Association, this model proved the practicability of a guidance and control system, which was later applied to the full-size International farm tractor, below.

"Robotug" cable-control battery-electric trucks are being employed by British Railways at Wolverhampton Herbert St. Goods Station.

RECENT successful applications of electronic control to farm tractors and industrial trucks may be indicative of developments in the fairly near future of far-reaching importance to the road-vehicle industry.

Many years ago it was forecast by electronic engineers that a road network would eventually be established that would provide automatic control of vehicles running at high speeds over long distances. This would enable the driver to relinquish control, or the vehicle to be guided to a terminal, without a driver.

It is not necessary, however, to take this long-term view to appreciate the more immediate scope of electronic control in the organisation of internal vehicle movements in warehouses and depots and, of possibly greater interest the control of electronically operated tugs for movements of vehicle trailers and so on at termini.

It is significant that, compared with the guidance of a tractor engaged in field operations, the automatic control of vehicles in a depot would be relatively simple.

Introduced last year by British Railways at Wolverhampton, Herbert Street Goods Station, a pilot scheme has been successfully operated whereby a number of Robotugs, supplied by E.M.I. Electronics Ltd., are automatically controlled to perform a series of movements in the railsheds. This affords a considerable reduction in the manpower required and many operational advantages.

A total of five Robotugs is employed and the vehicles are guided by cables, laid ½in below ground surface. These are energised by an alternating current of 1/16 of an amp. of specified frequency, each section comprising a single cable.

The magnetic field created by the current induces a voltage in two sensing coils located under the tug, and this is amplified by a two-stage transistor unit.

A reversible motor is connected to the steering linkage. If the tug deviates from the course, the voltage in one of the coils is increased, which causes the motor to actuate the steering in the appropriate direction to provide the necessary corrective.

In the event of current failure or breakaway of the tug, the brakes are automatically applied. A spring-loaded safety bumper on the front of the vehicle is fitted with a micro-switch, which opens the traction motor circuit if the tug encounters an obstruction, and the vehicle is brought to rest. Operating speed of the tug is 2 m.p.h.

Tug movements are controlled by a series of switches, connected to an electronic programming unit, actuation of which selects the route to be taken and the stopping points.

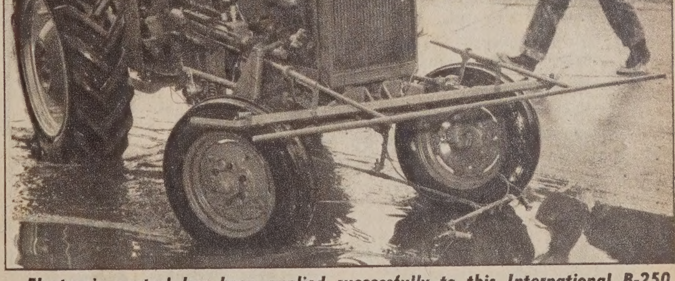
In a typical operation the tug is reversed into position in front of a number of loaded trolleys and automatically coupled to the leading trolley with the aid of switches on a terminal post and on the vehicle.

A starter button on the tug is used to switch in the programming circuit, and the vehicle automatically proceeds in sequence to various points in the shed. The tug automatically stops at each point and is restarted by operation of the starter button.

When the vehicle reaches the end of its route, actuation of a "homing switch" dispatches the vehicle back to the loading point. If the vehicle is required to operate outside the cable system it can be equipped with a manual lever for driver or pedestrian control.

A new type of automatic block system is in use whereby any number of vehicle trains can operate over a common network of routes. This system ensures that there is always an empty space between each train, and the form of programming control fitted to the vehicles enables an operator to select its destination at any point in the system.

Meanwhile, an electronically con-



Electronic control has been applied successfully to this International B-250 farm tractor by the Farm Mechanisation Dept. of the Reading University. Guided by a cable, the tractor can be operated without a driver to follow normal carting routes and to run a shuttle service between field location and plant. (Article and pictures by courtesy of the United Kingdom Office of information and "The Commercial Motor.")

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PERCY WILSON in "THE GRAMOPHONE" for October, 1960, says:—

> "On the whole I regard this design as a clever approximation to the ideal, and that at a very moderate price. I am willing to wager that those who acquire it will be surprised and gratified by the improvement it effects as compared with the ordinary commercial arm."

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trolled tractor evolved by the Farm Mechanisation Department of the University of Reading, in conjunction with the Electrical Research Association Field Station, can find its own way around a farmstead or be guided to a particular field.

It can operate on regular carting routes or, for example, on runs between a tanker combine and the grain receiving pit. A cable system is employed similar to the Robotug type, the sensing coils of the tractor being in circuit with a balance relay which controls solenoid-operated hydraulic valves

A conventional hydraulic steering booster is used, and oil is supplied to a double-acting ram in accordance with any correction of the steering required by deviation from course.

Electrical and hydraulic circuits can also be employed to provide an emergency braking system to operate the hydraulic lift or to engage the power-take-off shaft. If necessary, signals can be transmitted along the wire to stop the tractor, or to raise a mounted implement, without affecting the steering system.

When the control has been switched off, the tractor can be driven in the normal way. The cable system can be used for telephone communications at very little extra cost.

In the opinion of Mr K. E. Morgan, University of Reading Farm Mechanisation Department, the guidance of tractors under program control during field operation could best be provided by three infra-red-ray transmitters on the field boundary which would swivel in unison, and the tractor would follow the point of interception of the three beams.

The self-navigating control unit would be employed in place of the cable control system as soon as the tractor entered the field.

ROAD VEHICLES

The more complicated operations envisaged in this project show the potential of electronic control for road vehicles on site work. At a recent meeting of the Institution of Agricultural Engineers, West Midlands branch, in Birmingham, Mr Morgan read a paper on the "Electronic Control of Agricultural Machinery," and in answer to a question during the discussion said that large variations of load on the tractor could be accommodated automatically, given that the vehicle were equipped with a hydrostatic infinitely variable drive or the equivalent.

Reverting to the cable system, this could undoubtedly be applied to the movement of vehicle trailers (equipped with an electronic power trolley) in such a way that, once the vehicle was positioned in an appropriate parking area, all internal movements could be controlled by a switchboard operator from a central office, who would not necessarily have sight of the vehicles.

Although leader cables are normally laid below the surface of the ground, they can be located above ground for temporary operations. Because the signal between the cable and the vehicle sensing units is the function of a magnetic field, a film of mud or layer of grit on the cable does not affect the sensitivity of the system.

It would not seem far-fetched, therefore, to consider the possibility of tipping vehicles being operated automatically on short runs between loader and tipping area on an excavating site.

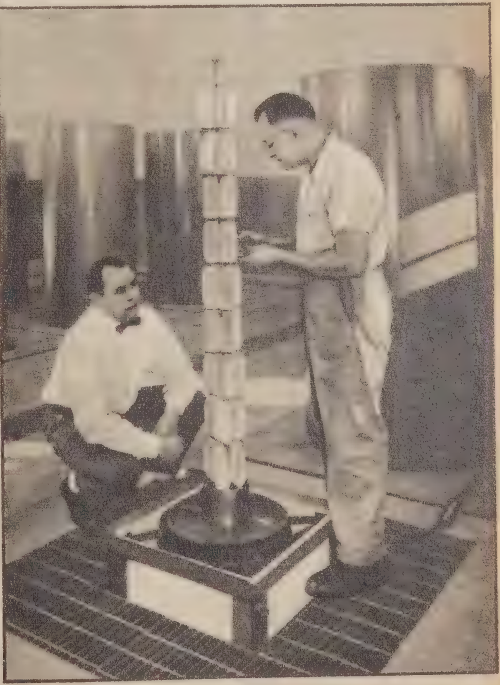
QUARTZ CRYSTALS---THREE WEEKS

After 50 years of research man is able to mass-produce Quartz Crystals, which are used in radio and television transmitters as well as telephone communications, radar and sonar.

THE man-made quartz crystals are being produced at the Merrimack Valley works of the Western Electric Company of the United States.

Previously the only source of quartz crystals has been Brazil and the supply has been unstable with high prices. At one stage during the last war, supplies were critically short.

The new factory, at North Andover, Massachusetts, grows crystals of superior size and quality in a sort of scientific rock garden under tremendous pressure and heat.



The process takes about three weeks and produces crystals at a fraction of the cost of natural crystals. In its natural form only 3 per cent of the quartz is used—the other 97 per cent is lost either because of imperfections or because of slicing operations.

This brings the cost of the quartz in the final plates used for electronic purposes to about 94 dollars an ounce—compared with the cost of gold, at 35 dollars an ounce.

In telephone work the crystals are at the heart of the equipment that permits many different conversations to be carried simultaneously over the same circuit.

With the reduced cost of man-made quartz it is possible that they may find wider use as substitutes for other elements in electronic circuits.

The dispensing of cosmetics is one field in which the pressure dispenser is extremely popular. The application of hair spray, as above, is a typical example, though why it should be necessary in this particular case seems rather hard to explain.

What makes it spray when you PRESS THE BUTTON?

Whether for insect sprays, hair lacquer, shaving cream, protection from fire in the family car, or any one of a host of other uses, it is a fair bet that most of us make use of the modern pressurised dispenser in one form or another. But have you ever stopped to consider what is behind these seemingly simple devices? This article tells something of their history, as well as the techniques employed in present day production.

By Calvin Walters

IN the realm of consumer goods nothing has captured the imagination of the buying public quite so much as these dispensers.

Beginning in a small way just over a decade ago, this method of packing is now used to deliver a host of products such as perfumes, insecticides, paint sprays, hair lacquer, sunburn lotions, shaving cream, paint removers, shampoos, deodorants, plant sprays, nasal sprays, waterproofing solutions, shoe polish, hand lotions and creams, together with a host of other products too numerous to mention.

People have become so accustomed to the idea of "press-button" living that little thought is given as to the whys and wherefores of the techniques used to provide these amenities.

To press a button on the top of a can in order to gain access to its contents seems simple enough. After all, haven't we seen something similar in the fire extinguisher used since grandad was a little boy?

In fact, the first application of the idea of expelling the contents of a container by pressure seems to have been thought out by two chappies named Helbing and Pertsch, who took out a patent in 1889 for a gadget which expelled ethyl chloride from a fine orifice.

This product is used in the medical field as a general anaesthetic and also as a local anaesthetic to freeze parts of the body so that minor surgery can be carried out.

With this scheme the ethyl chloride is contained in a glass tube provided with a valve which can be opened by pressing upon it. The ethyl chloride, being highly volatile, begins to evaporate by the heat of the hand and the pressure of the vapour inside the tube forces the liquid from the valve in a fine jet.

The common fire extinguisher mentioned above operates in a somewhat different manner. The body of the container contains a solution of sodium carbonate in water. Also enclosed within the container is a small bottle of sulphuric acid. When the extinguisher is inverted the acid mixes with the soda, thereby creating carbon dioxide gas. This builds up in the container, forcing the liquid contents out the nozzle of the attached hose.

The two systems described above are perhaps the simplest kind of pressurised dispenser. However, they bear only a general resemblance to what has become known in everyday parlance as an "aerosol."

Strictly speaking, the word "aerosol" is taken from colloidal chemistry and has been defined as a colloidal system consisting of very finely subdivided liquid or solid particles dispersed in and surrounded by a gas.

Since many of the early pressurised dispensers produced just such a condition in regard to insect sprays, deodorisers, etc., the word has been adopted by many to describe any form of pressurised dispenser. However, it is now often quite incorrect, since modern techniques have enabled a very wide range of products, no longer expelled in aerosol form, to be marketed in this way.

Most pressurised dispensers take the form of a container furnished with a valve at the top. From the valve a tube, called a dip tube, dips to the bottom of the container.

LOW BOILING POINT

If a liquid whose boiling point is below ordinary temperatures is sealed into the container, portion will vaporise and part will remain as a liquid. The gas will exert a pressure on the liquid part, so that when the valve is opened the liquid will be forced up the dip tube and out of the orifice of the valve into the atmosphere. Because of the low boiling point of the liquid it will evaporate immediately it reaches the atmosphere.

This is the principle of the pressurised dispenser in most of its forms.

It will be seen that a suitably chosen liquid, throughout which the product is dispersed, can at one and the same time be the medium which contains the product and the means of providing the required pressure to force the product through the valve. It becomes the propellant.

Most of the pressurised dispensers consist of this "two-phase system," as it is termed. There is the liquid phase and the gaseous phase. The liquid phase may consist of nothing but the product, or it may consist of product mixed with propellant.

It is easy to see what happens when the product-propellant mixture reaches the atmosphere. The propellant immediately vapourises, leaving the product in the air or on the surface desired.

To make a pressurised dispenser requires a considerable amount of research. It is not just a matter of getting the container and valve together with a mixture of propellant gas and product.

TYPE OF SPRAY

The nature of the spray required governs the choice of mixture and the kind of valve necessary.

The vapourisation of the product-propellant mixture in the atmosphere causes the product to be broken into fine particles. On the size of these particles depends whether we have a "space spray," which remains suspended in the air, or a surface ("wet") spray, which does not remain suspended.

Insecticides, deodorants, and so on, are space sprays. Hair lacquers, paint removers, and so on, are surface sprays.

The size of the particles depends on the proportions of product dispersed in the propellant solution. In space sprays the amount of product in the liquid is low, something in the order of two or three per cent.

Such a low proportion of product is easily broken up by the violence of the emission from the valve and becomes small colloidal particles, or "aerosols" in the true sense of the word.

When the proportion of product is increased, possibly up to 75 per cent of the mixture, the particle size on emission is too large to remain airborne and the spray becomes a "surface" spray.

Sometimes it is not possible to disperse the product in the propellant. In such cases the liquid phase is product only, while the compressed gas is contained in the rest of the container.

When the valve is opened the pressure of gas forces the product up the dip tube and out of the orifice, but there is no scattering effect. Special valves have had to be designed which break up the stream being emitted from the orifice and form a spray.

Just a few of the many products now available in this form, ranging from perfume to paint.

This fact brings to mind a rather interesting — and amusing — experiment recently carried out by a colleague. Due to a strong Scottish ancestry he always regarded the discarding of an exhausted dispenser as a wicked waste; something which Providence would be sure to punish in the course of time.

Why, he reasoned, was it not possible to refill such devices if one was prepared to go to a little trouble? All that was needed was a refill of the contents and some form of pressure to expel it. Surely that should not be beyond the limits of his ingenuity.

So he saved the next empty dispenser, at the same time doing the rounds of the local small boys in search of a discarded bicycle tube. When he found one he salvaged the valve and was all set for the great experiment.

A suitable hole was drilled in the top dome of the container, the valve inserted, and very carefully and securely soldered into place. The liquid contents were added through the body of this valve, the "works" of the latter fitted, and half a dozen firm strokes of a bicycle pump used to replace the pressure.

FAILURE

Alas for his hopes! When the button was pressed there was no spray, only a fine jet of liquid quite useless for the intended purpose. Experiments with various quantities of liquid and moderate variations of pressure were of no avail; all that came out was the same thin jet as from a water pistol.

Although puzzled at the time, he now knows the reason: the fact that the propellant normally forms part of the liquid contents, and that its change from liquid to gas as it emerges from the nozzle is used to produce the spray.

Although still somewhat disappointed, he is at least satisfied that he was trying to achieve something close to the impossible.

Those who use pressurised dispensers of shaving cream and shampoos may have often wondered how a seemingly limitless supply of foam can be contained in such a comparatively small container.

The truth is that the dispenser contains no foam at all. In these systems the product is mixed with about 15 per cent of liquid propellant to form an emulsion. When the valve is opened, the emulsion passes up the dip tube and out the orifice of the valve. When it reaches the atmosphere the dissolved propellant immediately vaporises, and in doing so the product is filled with innumerable gas bubbles swelling up into a foam.

We all know how much froth can be gained by whipping up a small quantity of soapy water, and it is easy to see how a few ounces of a suitable product can give many times its bulk of foam when scientifically whipped up by a dispenser.

Sometimes no dip tube is provided in a foam dispenser. In such cases the dispenser is usually fitted with a special valve called a "foam head," and the dispenser must be inverted to make it operate. The reason, of course, is to bring the product to the "bottom" of the dispenser, where it will reach the valve orifice.

The type of propellant used depends on whether the product is a food line or a non-food line.

For non-food products, volatile liquids are usually used, whilst compressed gas is used for food products.

The principal advantage of using a liquefied gas as a propellant lies in the fact that the required pressure is maintained down to the last drop of propellant.

This is due to the fact that it is the vapour pressure which exerts its influence to expel the contents. So long as the liquid is one which is highly volatile, and therefore keeps filling the constantly increasing space in the container with gas, then the system will continue to function. Further, the pressure will remain constant while ever a drop of propellant remains.

For the technically-minded reader it may be interesting to know what substances are used as propellants.

For non-food products the Fluorohydrocarbons are those mostly used. Some will be recognised as being used in refrigerator systems. These are Freon, Fridgedohn, Arctron, and so forth.

Also included are Trichlorofluoromethane, Dichlorofluoromethane, Chlorotrifluoroethane, etc. There are some thirty of these substances available, mostly in the fluoromethane and fluoroethane groups.

SINGLY OR MIXED

These have their own characteristics as to vapour pressure, solubility, etc., and can be used either singly or mixed to vary the characteristics for specific purposes.

The pressure of the gas in the container may be anything up to 30lb or 40lb per square inch, which brings us to a consideration of the needs of the container in order to hold the pressure without leaking.

Great care must be taken in the selection of the right material for making the cans. Due regard must be given to the strength of the material and its resistance to corrosion, since many products can be corrosive to particular materials. If corrosion takes place in the can it is thereby weakened, with a risk of explosion when handling or even when standing on the shelf.

The body of the container may be made of aluminium, steel, glass or plastic material. Most containers on the market are of steel or aluminium.

A picture of the can is given elsewhere and it will be seen to consist of a cylindrical body with a concave bottom for strength.

(An empty container can be taken to pieces for inspection but it is desirable to remove the valve and allow any residual gas to escape before attacking the can.)

The can is usually seamless at the side, while the top is dome shaped, again

Dispensing insecticides, essential to healthy living, is a "natural" for the pressure dispensers. Many are true aerosols, leaving the insecticide suspended in the atmosphere, but a few, intended for spiders, ants, etc., are surface sprays. Propellant-product ratio governs the type of spray.

SIMULATING SUNLIGHT IN SPACE

BRIGHT sunshine and sparkling snow on the side of Mt. Rainier, about 100 miles from Seattle, U.S.A., recently provided unusually pleasant working conditions for a pair of Boeing research engineers studying conversion of sunlight to electricity. Their laboratory was a parking lot at Paradise Lodge, at an elevation of 5,557 feet. (See cover picture.)

The engineers were Henry Oman and Roger Gillette, of the Aero-Space Division's technology department. They are investigating concentrators to increase the amount of electricity obtainable from silicon solar cells used in today's satellites and future space vehicles. The cells convert sunlight to electricity with an efficiency up to about 15 per cent.

Solar cells are expensive. Enough of them to light 10 100-watt bulbs would cost about 350,000 dollars. The relatively small satellites of today require about 10 to 200 watts.

Oman and Gillette have adapted a Somor concentrator to solar-cell use. Silicon cells are mounted in the concentrator, which is oriented to face the sun. The specially anodised aluminum surfaces of the concentrator reflect additional sunlight to the cells.

Studies such as the one at Mt. Rainier will help determine the concentrator design best suited to space use. The mountain location provides illumination intensity approaching space conditions. Absence of haze eliminates variations which could confuse test results.

Oman explained that, while an airplane could take the test instruments higher, instrument stability is necessary and tests cannot be conducted through windows.

In a test, the concentrator is mounted on a platform with a pyreheliometer —an instrument which measures sunlight intensity. Concentrator and pyreheliometer are aimed directly at the sun. A weight-driven clock mechanism enables the instruments to track the moving sun by rotating the platform about an axis parallel to the earth's polar axis.

Roger Gillette adjusts the automatic sun tracker, while a jetliner traces a vapour trail high in the stratosphere.

By comparing sunlight intensity shown by the pyreheliometer with the output of the cells in the concentrator, the researchers can determine the concentrator's efficiency.

The solar intensity at Mt. Rainier was more than 100 watts per square foot. In space the reading would be about 130 watts. An average sunny Seattle day provides only 60 or 70 watts.

Results of the test indicate that the Somor Concentrator increases silicon-solar-cell output about 45 per cent. At 350,000 dollars per kilowatt, this boosted capacity could produce substantial reduction in the cost of electrical power for space vehicles and satellites. (Boeing Magazine.)

Pressure Sprays

for strength, and seamed around the top edge.

The valve is inserted into a disc of metal which in turn is fixed to the centre of the domed top and sealed with a rubber gasket. The whole article is one designed for strength.

The valves used in the cans are a work of precision which, unfortunately, have to be discarded with the can when it is empty.

The most common valve consists of a nylon housing into which is inserted a stainless steel spring.

Inside this is a valve stem of metal or nylon provided with an orifice. The whole is inserted into a plastic button provided with an external orifice of about two one-hundredths of an inch in diameter.

Underneath the valve stem is a rubber gasket against which the stem is held by the spring. When the actuating button is pressed the valve stem is pressed away from the rubber seal and pressure forces the liquid up the dip tube into the valve stem, through the internal orifice and out the external orifice.

In addition to the simple construction outlined above these valves are provided with a series of orifices connected together by passages. These act as expansion chambers which provide a pressure drop at each one.

As the product-propellant mixture reaches each expansion chamber, the resulting drop in pressure brings about a partial boiling. The result is that at the final orifice violent boiling has taken place and complete vaporisation of the mixture results.

"Break up" valves have swirling chambers which force the product through the orifice in the form of a spray. These are used in systems, mentioned earlier, where the liquid phase is pure product and is forced out of the can by compressed gas which provides no atomising action.

Then there are foam valves which are ordinary valves with a large orifice of some .3 inch in diameter. There are also metering valves which deliver a specified quantity of the contents at each pressure of the button.

These are used in the medical field where predetermined doses of medicine are required to be delivered. This valve is constructed in such a way that the product is admitted into a chamber of the desired capacity on the downstroke of the plunger, and released through the external orifice on the upstroke. This is something like the action of an old-time pump on an underground well.

There are also valves which eject the whole contents of the can at one go. These are mostly used for fire extinguishers.

FILLING METHODS

The filling of the can with the product and gas propellant is a feature of its own, and is done by two main methods, known as "low temperature filling" and "ambient temperature filling."

The first is achieved by cooling the propellant to well below its boiling point temperature before measuring it into the can. The product is also precooled and metered into the can in its correct proportions.

For this method the contents are fed through the opening which exists in the can before the disc holding the valve in the centre is fixed into place.

Between the stage of filling and sealing, a short time interval is allowed to enable the propellant to reach a temperature where it begins to vaporise or boil. This allows the head of the can to fill with gas and thus displace all air before it is sealed. This is a very important part of the operation, as the presence of air in the container can affect both the pressure and the quality of the product.

With the "ambient temperature" method, the contents are fed into the

(Continued on Page 127)

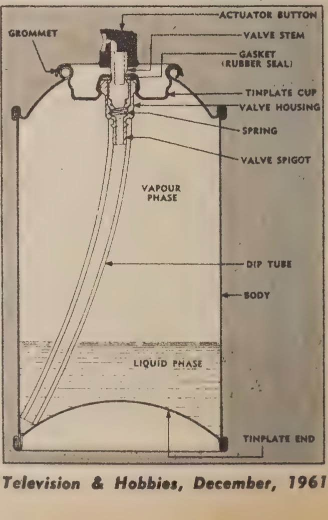


Diagram of a typical pressure dispenser. Note the domed end construction to withstand the internal pressure. In many cases the "liquid phase" is a mixture of product and propellant.

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KM54a KM56 U67 U47

NEUMANN Microphones are manufactured from A to Z in the Neumann plant. Their quality and reputation for reliability are such that they are now in regular use where the demands for quality are highest: in the Australian Postmaster-General's Department, in the Australian Broadcasting Commission's Television Services; and at all leading Australian Television, Recording and Sound Broadcasting organisations. Throughout the world, they have been standard equipment in all major Television, Film and Recording studios for many years

A number of types, including miniature and stereophonic models with a variety of pattern characteristics, some of which are variable at will, are available as follows:

Model	Type	Frequency response c/s (± 3 dB)	Polar diagram	Sensitivity (mV/dyne/cm²)	Total harmonic distortion over entire range up to 110 dB intensity level (1,000 c/s.)	Output impedance (ohms) changeable	Load impedance (ohms)	Dimensions le.	Dimensions dia.	Weight	Power unit	Microphone cable (33 feet)
KM 54a	pressure gradient	40-15,000	cardioid	1	less than .4%	50 or 200	250 or 1,000	5⅛"	⅞"	4 oz.	NKMa	KC2
KM 56	pressure gradient	40-15,000	omni-dir./cardioid/ fig. of "8" (switchable)	.8	less than .4%	50 or 200	250 or 1,000	5⅞"	⅞"	4.6 oz.	NKMa	KC2
SM2 (stereo)	pressure gradient	40-15,000	omni-dir./cardioid/ fig. of "8" (remote controlled)	1	less than .4%	50 or 200	250 or 1,000	8¼"	1⅛"	9.5 oz.	NSM	SC2
U67	pressure gradient	30-60,000	omni-dir. cardioid bi-directional	1.3 2.2 1.3	less than .4%	50 or 200	250 or 1,000	8"	2¼"	1 lb.	NU67	UC5 or UC6
U47	pressure gradient	35-15,000	omni-dir. and cardioid	2.5 (cardioid)	less than 1%	50 or 200	250 or 1,000	9"	2½"	1½ lbs.	NG	UC4

Model U67 is the latest addition to the NEUMANN Range, and has the following additional features:

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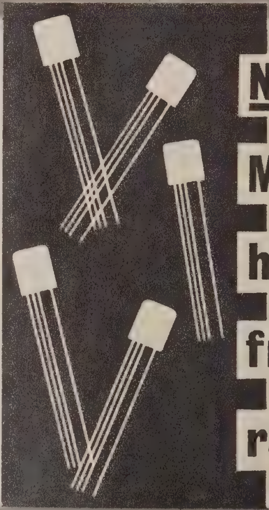
OC169 - OC170 - OC171

Transistor Type	OC169	OC170	OC171	
Collector Voltage (Vcb max.)	—20	—20	—20	V
Collector Current (Ic max.)	10	10	10	mA
Max. Dissipation (25° C)	80	80	80	mW
Typical parameters at (measured at Vce = —6V, Ic = 1mA)	0.45 (common emitter)	10	100 (common base)	Mc/s
Input Conductance	0.4	2.5	23	mmhos
Input Capacitance	80	.65	—6	pF
Feedback Admittance	< 100	100	600	μmhos
Transfer Admittance	36	32	14	mA/V
Output Conductance	7	60	350	μmhos
Output Capacitance	7	4.5	2.6	pF
Ideal Unilateralised power gain	61	32	> 10dB	



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Broadcasting Control Board Announces

HIGHER POWER FOR A-M DETAILS OF COUNTRY TV

The Thirteenth Annual Report of the Australian Broadcasting Control Board contains a number of items concerning the technical progress of both radio and TV in Australia. The following is a summary of those which we feel will be of most interest to readers.

IN the radio field there is news of increased power for several national stations, the granting of a special low power licence for restricted local coverage, the synchronous operation of two transmitters on the same frequency, and of experiments with compatible single sideband systems for use on the broadcast band.

Details of the new stations and increased power are contained in paragraphs 30 and 31, pages 15 and 16.

"As mentioned in the Board's twelfth annual report, 18 of the 22 proposed new stations . . . are now in operation, the following three new stations having commenced service during the past year:

"4MI Mount Isa, July 11, 1960.

"8KN Katherine, July 7, 1960.

"8TC Tennant Creek, July 5, 1960.

"The position regarding the other four stations is as follows:

"2AN Armidale. Following negotiations with the New Zealand administration the Board, in April, 1961, confirmed the following operating conditions for this station: Power, 50 watts; frequency, 760 Kc, sharing with station 2NB Broken Hill.

"This station, which is intended to provide a service only for the city of Armidale, is expected to commence operations about March, 1962.

"3BN Bendigo. The Minister, in April, 1961, on the recommendation of the Board, approved the deletion of this station from the Board's plan. This step was taken following the increase in power of station 3WV Horsham to 50,000 watts in August, 1960, as a result of which the grade of service provided in Bendigo is now regarded as satisfactory. In addition, the quality of reception in that city from the Melbourne stations 3AR and 3LO will be substantially improved when these stations' power is increased to 50,000 watts.

"The power of station 3WV Horsham was increased on August 31, 1960, from 10,000 watts to 50,000 watts; the power of 5AN Adelaide will be increased from 2,000 to 10,000 watts on September 20, 1961, and, on the same date, the power of 5CL Adelaide will be increased from 10,000 to 50,000 watts. The power of 6WF Perth will be increased from 5,000 to 50,000 watts on September 18, 1961. It is expected that both 2FC and 2BL in Sydney will be increased from 10,000 to 50,000 watts during 1961-62.

"The Board has referred in previous reports to the need for improvements in the broadcasting service in certain parts of Queensland, but the difficulty of providing frequency channels for additional stations in that State delayed the preparation of plans for effecting improvements. During the year, however, this difficulty was overcome and the Minister, in March, 1961, on the recommendation of the Board, approved plans for improving the service in Queensland by the establishment of three new medium frequency stations and the increase in power of an existing station, as follows:

NEW STATIONS

"South and South-West Queensland: Power, 10,000 watts; frequency, 710 Kc, sharing with station 7NT Kelso, Tasmania. Both stations will be equipped with directional radiating systems.

"Emerald area and districts: Power, 50,000 watts; frequency, in the band 1,500 to 1,600 Kc.

"Eidsvold, Monto and Theodore areas: Power, 10,000 watts; frequency, 910 Kc. This station will operate in synchronism with station 4QB Pialba.

INCREASE IN POWER

"4AT Atherton, from 500 to 2,000 watts."

The Board also lists a number of changes regarding commercial stations.

Two new stations commenced operation, 8DN at Darwin and 4LM at Mount Isa, while a number of stations are using increased power. Both 2KA Katoomba and 2KM Kempsey have a night-time increase in power from 1,000 to 2,000 watts, while 3AK Melbourne has a full-time increase from 500 to 2,000 watts.

Daytime increases in power from 1,000 to 2,000 watts were effected by the following stations:

3BA Ballarat, 3BO Bendigo, 3CS Colac, 3CV Maryborough, 3GL Geelong and 3YB Warrnambool.

In South Australia, 5AU Port Augusta increased its power from 500 to 2,000 watts, operating from a new site with a directional aerial.

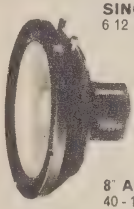
Area and Transmitting Site	Aerial Pattern	Polarisation	National Channel and Offset	Commercial Channel and Offset
Canberra (Black Mountain)	Omnidirectional. Special vertical pattern.	Vertical	Ch. 3 — 10 kc/s	Ch. 7 + 8 kc/s
Newcastle-Hunter River (Great Sugarloaf)	Omnidirectional	Horizontal	Ch. 5 + 8 kc/s	Ch. 3. No offset
Illawarra (Knight's Hill)	Maxima along coast	Horizontal	Ch. 5a. No offset	Ch. 4. No offset
Central Tablelands (Mt. Canobolas)	Omnidirectional	Vertical	Ch. 1 + 8 kc/s	Ch. 8 + 8 kc/s
Richmond-Tweed (Mt. Matheson)	Omnidirectional	Horizontal	Ch. 6 + 10 kc/s	Ch. 8. No offset
Ballarat (Lookout Hill, near Mt. Buangor)	Minimum toward Goulburn Valley	Horizontal	Ch. 3 — 12 kc/s	Ch. 6 — 2 kc/s
Bendigo (Mt. Alexander)	Maximum to north	Vertical	Ch. 1. No offset	Ch. 8. No offset
Latrobe Valley (Mt. Tassie, near Callignee)	Maximum toward E. Gippsland	Horizontal	Ch. 4 — 10 kc/s	Ch. 10 — 4 kc/s
Goulburn Valley (Mt. Major)	Minimum toward Ballarat	Vertical	Ch. 3 — 20 kc/s	Ch. 6 + 6 kc/s
Darling Downs (Mt. Mowbullan)	Maximum toward Toowoomba	Horizontal	Ch. 3 + 2 kc/s	Ch. 10 + 10 kc/s
Rockhampton (Mt. Hopeful)	Omnidirectional	Horizontal	Ch. 3 + 10 kc/s	Ch. 7 + 10 kc/s
Townsville (Mt. Stuart)	Omnidirectional	Horizontal	Ch. 3 + 18 kc/s	Ch. 7. No offset
N.E. Tasmania (Mt. Barrow)	Maximum along North Coast	Horizontal	Ch. 3 — 50 kc/s	Ch. 9 — 12 kc/s

ARMIES OF AMPLIFIERS
LEGIONS OF PICKUPS
PROFUSIONS OF PRE-AMPS
TORRENTS OF TURNTABLES
STACKS OF STEREO
MOUNTAINS OF MONO . . .

but only one

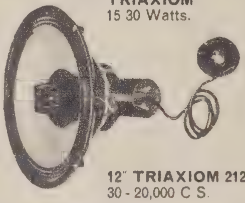
GOODMANS

SINGLE CONE
6 12 Watts.



8" AXIETTE II
40 - 15,000 C S.

TRIAXIOM
15 30 Watts.

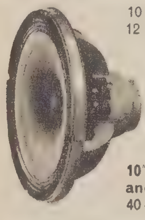


12" TRIAXIOM 212
30 - 20,000 C S.

LOUDSPEAKER SYSTEMS
2-WAY 15 to 40 Watts.

12" AXIOM with TREBAX.
30 - 20,000 C S.

10 20 and
12 24 Watts.



10" AXIOM 110
and 112
40 - 15,000 C/S.

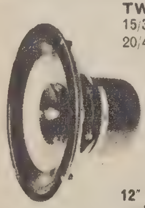
20 40 Watts.

12" TRIAXIOM 412
30 - 20,000 C/S.

LOUDSPEAKER SYSTEMS
3-WAY 15 to 50 Watts.

12" or 15" AUDIOM Bass Unit
with MIDAX and TREBAX Horns.
25/30 - 20,000 C/S.

TWIN CONE
15/30 and
20/40 Watts.



12" AXIOM 300
and 350
30 - 16,000 C/S.

25/50 Watts.

15" TRIAXIOM 615
25 - 20,000 C/S.

Power Ratings. The second figure shown refers to U.S.A. formula.

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This latter change, in conjunction with the installation of a directional aerial at 2MG Mudgee on the same frequency, has resulted in a substantial extension of the night-time service areas of both stations. The service is now limited by fading rather than co-channel interference. A similar setup is planned for 7SD Scottsdale and 4QL Longreach, which also share a common channel.

In paragraph 36, page 17, the report makes mention of investigations into a compatible single sideband system for broadcasting.

"During the year it was decided to consolidate earlier work conducted in 1957 which dealt with a theoretical study of the Kahn compatible single sideband system. This study revealed the basic minimum requirements with respect to single signal modulation, and the study is being continued to determine the requirements for complex signal modulation forms.

SUPERIOR SYSTEM

"Work completed so far shows the ideal single sideband system to be superior to the double sideband system at present used for sound broadcasting in the medium frequency band. The superiority is mainly associated with more efficient use of the radio frequency spectrum (i.e., the single sideband system enables more channels to be provided), but this also requires a receiver with certain characteristics, which, however, is not necessarily more complex than existing double sideband receivers.

"Determination of the minimum requirements for complex signal forms will complete the theoretical study and provide a criterion for assessing the value of single sideband systems in practice."

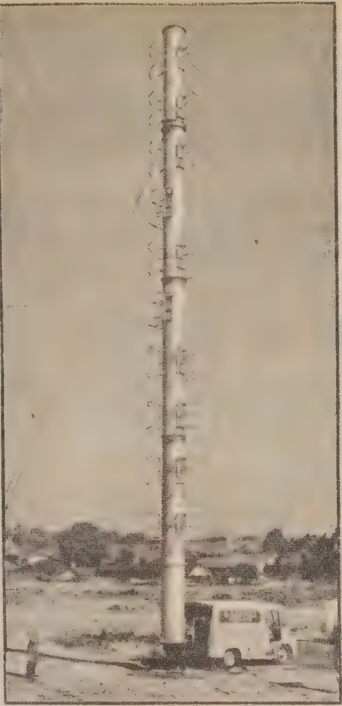
(Editorial note: Although various aspects of the above system are being investigated, there is nothing in the board's report to indicate that it has any firm plans to introduce such a system into the present broadcast band.)

In regard to TV, probably the most important single announcement concerned the extension of services to country areas, along with the decision to increase the number of channels from 10 to 13 (R., TV and H., April, 1961, page 79). In the current report, the board gives details of the localities, channels, polarisation, aerial directivity, frequency offset, etc. This information is summarised in the accompanying table.

NEW TECHNIQUES

It will be noted that these technical requirements embrace conditions not previously applied to Australian television stations, namely, the use of vertical polarisation, and of a complete system of frequency offsets. These measures, together with directional aerials, have been adopted mainly to permit the operation of pairs of co-channel stations at moderate geographical spacings with minimum mutual interference. The possibility of additional stations on the same frequencies in the future has also been considered.

Some of the directional aerials have been required to improve coverage in certain districts, and some of the frequency offsets are necessary to avoid interference to other radio services located close to the transmitting sites. The amount of offset is insufficient to have any noticeable effect on the tuning of receivers.



A television aerial for one of the new country TV stations. Designed and built by Amalgamated Wireless (Australasia) Ltd., it is the first Australian made TV aerial. It was recently delivered to Gippsland-Latrobe Valley Telecasters Ltd., for erection on their site at Mt Tassie. A feature of the aerial is the directional characteristic required by the Broadcasting Control Board, as detailed on the previous page. Effective radiated power in the direction of maximum propagation will be 300kW. Height of the aerial is 68ft, and weight three and a half tons. AWA has also made the vision and sound transmitters and studio equipment for this station.

Another interesting feature concerns the enactment of legislation to permit the installation of "community television systems," i.e., the erection of a communal aerial at a suitable vantage point to feed signals to an isolated community which, by reason of topography, etc., cannot receive satisfactory TV signals in the normal way.

The official wording is quite lengthy and involved, but briefly it is aimed at overcoming the legal problem previously existing, whereby a section of the Post and Telegraph Act prohibited the use of a "telegraph line" for the transmission of radio or TV programs (other than on private property) in this way.

NEW POWER

It now empowers the Minister to issue a permit to use a telegraph line for this purpose. Permits will be issued for five years, the fee will be £50, and the fee for a transfer of the permit £2. For the time being it is proposed to grant permits only for systems within the normal range of an existing station.

In regard to the use of video tape for TV program recording, the board reports considerable expansion. Twelve machines are already in use, and another ten are due for delivery. Seven of these are for the national stations.

In regard to the quality of such recordings, the board says (paragraph 89, page 35):

"While the quality of tape recordings transmitted from the station of origin is generally high, considerable difficulties have been experienced with the physical interchange of video tapes between stations, and this has led to somewhat variable picture quality, particularly where interchange between stations with tape recorders of different manufacture is involved.

"Engineers employed by the stations and the board's technical staff are co-operating to establish standard operating practices, and some improvement in picture quality is being achieved.

"Difficulties which have been experienced with the locking of some receivers to video tape transmissions are likely to disappear with the general introduction of synchronisation locking circuits. These devices lock the video tape output to the station timing pulses, instead of vice-versa."

PHASE FOUR-COUNTRY TV AREAS

ON October 18, in Canberra, the Postmaster-General, Mr C. W. Davidson, announced the commencement of phase four of the establishment of TV stations in Australia. This provides for extension of TV to the more remote country areas, as follows:

NEW SOUTH WALES: Tamworth, Grafton-Kempsey, Taree, Dubbo, Broken Hill, Murrumbidgee Irrigation Area, Wagga-Cootamundra, Bega-Cooma.

VICTORIA: Upper Murray, Mildura, Murray Valley-Swan Hill.

QUEENSLAND: Wide Bay-Maryborough, Cairns, Mackay, Warwick.

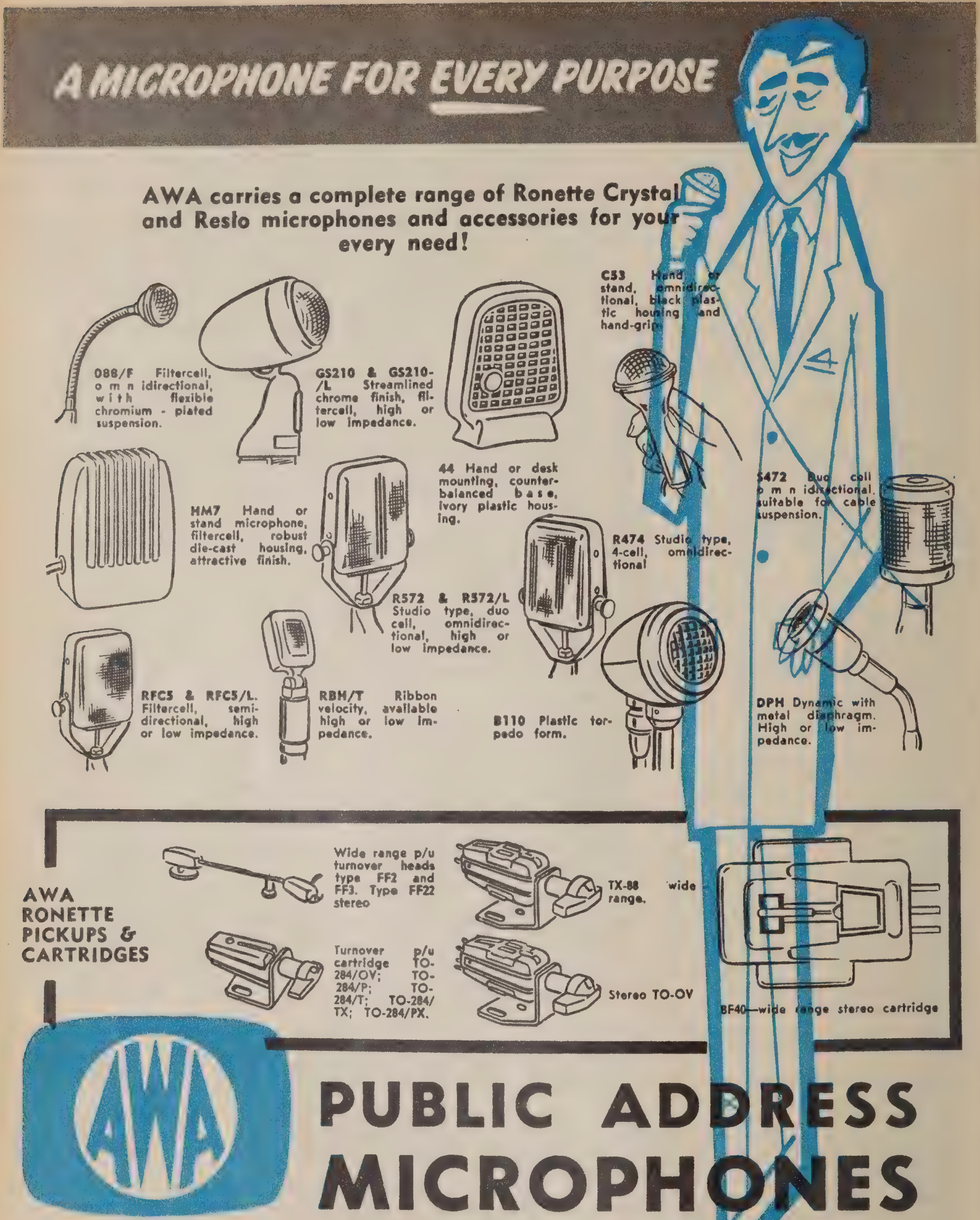
SOUTH AUSTRALIA: Spencer Gulf North, Mount Gambier.

WESTERN AUSTRALIA: Bunbury, Katanning-Albany, Northam-York.

(These are, of course, additional to those stations detailed on page 17).

National stations are to be established in each of these areas, and applications invited for one commercial licence in each area. Priority will be given to local companies provided they can conform to the Board's standards.

It is expected that the fourth phase of national television stations will be completed during 1966-67, which should mean that 91 per cent of the Australian population would be within a viewing area. The cost of the phase four national stations will be £9,500,000.



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RBH/T Ribbon velocity, available high or low impedance.

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DPH Dynamic with metal diaphragm. High or low impedance.

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Technical Review

MANY USES FOR THERMOELECTRIC COOLING UNITS

There has been considerable interest in recent years in schemes which provide refrigeration by using certain characteristics of the thermocouple. Although the effect has been known for years, it is only with the development of semi-conductor materials that any practical results have been obtained. This article describes a typical commercial unit.

IN 1822 Seebeck discovered that an electric current arises in a closed circuit of different conductors when two junctions are at different temperatures. Twelve years later Peltier, a French watchmaker, observed temperature anomalies in the vicinity of the boundary between dissimilar metals when a current passed through them. The true significance of the Peltier effect was recognised by Lenz in 1838. He showed that a droplet of water placed in a dent at the junction of bismuth and antimony rods, could be frozen by the passage of current through the junction and melted by reversal of the current.

Lenz was probably helped in this experiment by the low temperatures in St. Petersburg where it was carried out, for otherwise he could not have been expected to produce ice in this way. By consideration of the latent heat of fusion of ice it became obvious that depending on its direction, an electric current, generates or absorbs heat at the junction of two conductors.

RECENT DEVELOPMENTS

Metallic thermocouples have been used for temperature measurement for some considerable time and the Seebeck effect can be demonstrated easily. The Peltier effect, however, has been too small to provide a convincing demonstration even with the best chosen combination of metals. New materials recently developed, such as "p" and "n" doped bismuth telluride, are semi-conductors which provide a greatly enhanced Peltier effect, and using a single junction between "p" and "n" type materials, the freezing of water is easily demonstrated.

The Peltier effect is the generation or absorption of heat at the junction of two dissimilar metals or semi-conductor materials when a direct current is passed across the junction. The generation or absorption depends on the direction of current flow across the junction and is superimposed on the normal Joule heating effect which is distributed evenly throughout the materials.

The first of a range of thermoelectric cooling units to be marketed by a British manufacturer has been introduced by Salford Electrical Instruments Ltd. (a subsidiary of The General Electric Co. Ltd.) following an extensive research program at the G.E.C.'s Wembley laboratories.

Based on the Peltier effect, the cooling capacities of the units vary from less than 1 watt for a single junction type to more than 10 watts for a large multiple junction. They thus cover a range which cannot be conveniently dealt with by conventional means of refrigeration.

The first of the group to be readily available is the BT.4, a four-junction unit with a cooling capacity rated nominally at 1 watt, although the rating can be increased with a resultant reduction in temperature depression. Alternatively, a greater temperature depression can be achieved by reducing the rating.

The BT.4 is made in the shape of a small cube, and thermal junctions are formed by a combination of "p" and "n" types of a bismuth telluride semi-conductor material. In use, the block is clamped between the object to be cooled and heat sink. Typical of its many applications is the cooling of electronic components which must operate in high ambient temperatures, when it serves to increase the power ratings of transistors, reduce the dark current in photo-transistors, or—in the case of quartz crystals — to allow operation at the inversion point or other selected part of the frequency deviation/temperature characteristic.

Other applications are with laboratory equipment such as microtome knives or microscopic slides where local cooling is essential; with instruments such as dew-point hygrometer heads, where thermoelectric cooling involves changes in techniques and resultant simplification in the equipment; and with the cooling of small volumes by incorporating one or more units into the walls of a chamber. Here, the temperature may be held constant by a proportional controller which allows smooth regulation of the cooling rate via the D.C. current applied.

Summarising the advantages of these devices, the makers list the following points:

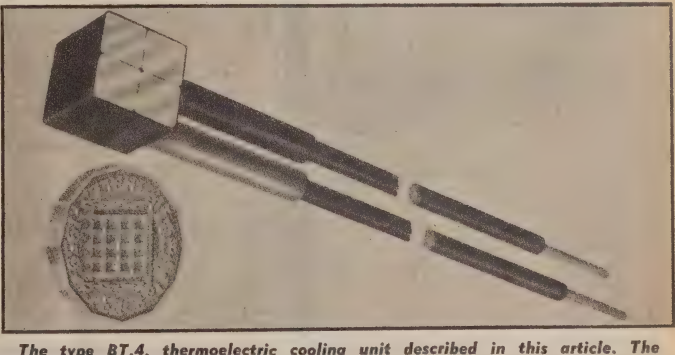
(1) The cooling power can be varied continuously as required by simply varying the current applied, and the unit is therefore ideally suited to incorporation in automatic control systems.

(2) The cooling may be reversed to heating by simply reversing the direction of current flow, thereby obtaining temperature control above or below ambient temperature as required.

(3) The compactness of the cold surface makes it most suitable for local cooling where cooling powers of the order of 1 or 2 watts are required and conventional refrigeration cannot readily be applied.

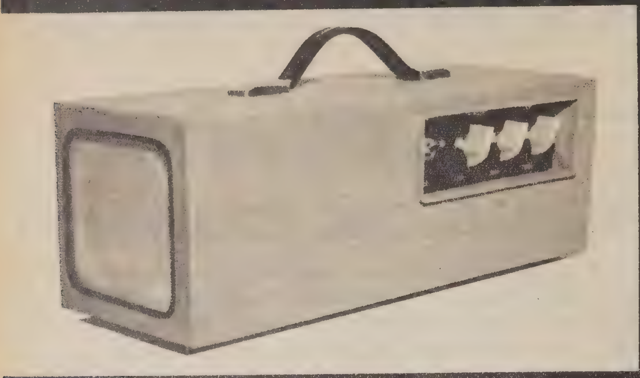
(4) It is silent and reliable, since no moving parts are used.

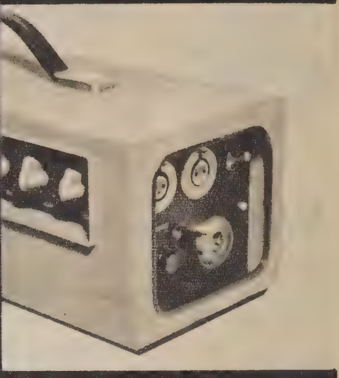
(5) The cooling units are not affected by vibration or attitude.



The type BT.4. thermoelectric cooling unit described in this article. The thermocouple unit proper is a cube measuring ½in on all dimensions.

AMAZING VALUE





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Transistors — 2-2N217, 2-2N217S, 2-2N301
Output Impedance — 15 Ohms
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Maximum Output — 1.1 A
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Inputs — Microphone and Gramophone
Sensitivity *(For Full Output)* — Micr. 1.0 mV RMS. Gram. 150 mV RMS

Personal Public Address Amplifier

The de Havilland Personal Public Address Amplifier has been designed to cater for the requirements of lecturers, demonstrators, and sporting coaches, etc.

The unit consists of a transistorised package amplifier operating into a five-inch speaker. It is housed in an attractively finished case measuring 8″ x 5″ x 3″, fitted with adjustable carrying straps.

The unit may also be used in conjunction with a microphone with a flexible lead as a low-powered fixed speaker unit.

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TECHNICAL REVIEW

TWO UNIQUE ANTENNA DESIGNS FOR "TROPO-SCATTER" VHF LINKS

Much research is currently being devoted to the development of antennas for long distance VHF "tropo-scatter" links. As well as having suitable electrical characteristics, such antennas must be economical to make and erect, immune to a wide range of weather conditions, and easy to maintain. Two new designs recently announced by the Boeing Company of U.S.A. are typical of the approaches to this problem.

The new fibreglass reflector, which has many advantages over the metal variety, particularly under extremes of temperature.

THROUGH the use of such antennas, voice, television and numerical symbols, such as computer data, can be sent as far as 500 miles without signal boosters between points. By positioning reflectors strategically on ocean islands and specific points of land masses, instantaneous, world-wide communication, including television, is theoretically possible.

The tropospheric scatter technique uses successive layers of violently disturbed air some 20 miles up to bounce high frequency radio waves to another "tropo-scatter" antenna many miles away. In effect, the tropo-scatter system bounces signals over the horizon by using a natural reflector in the sky. Shortwave radio does much the same thing, using the higher ionosphere for its reflector. But shortwave is subject to fadeout and interference from atmospheric changes.

RELIABLE COMMUNICATION

The brute force of as much as 100 kilowatts of power at frequencies between 400 and 4,000 megacycles makes signal transmission by tropo-scatter steady and dependable. This strong signal not only maintains reliable communication but allows the transmission of as many as 1,000 messages at one time.

The Boeing Company's Antenna Department has developed two new tropo-scatter antennas, both having unique characteristics. The first, which has already been sold to Page Communications Engineering Incorporated, is destined for overseas army communications.

Available with reflectors 30, 60 and 120 feet across, the antenna is assembled on site from only a quarter as many parts as conventional tropo-scatter antennas. Its simplicity lies in pre-formed and pre-drilled steel girder construction.

Principal advantage of the new design is the five to ten per cent lower initial cost and the ease of assembly, reducing installation costs by as much as 5,000 dollars per 60-foot antenna. Parts can be colour-coded so that unskilled, non-English speaking workers can erect the antenna in virtually the same time a trained crew could do it. Eight men can erect a 60-foot antenna in 50 hours.

Because there might be occasions when a powered crane is not available to a steel rigging crew, Boeing has designed the wooden packing crates in which antenna parts are shipped to do double duty. Timbers from the crates are drilled for assembly into a "gin pole"—an upright post which, with a cable and pulley, can be used for heavy lifting. The gin pole, with a truck winch or crew of strong men, can hoist antenna structures into place.

David Cohen, Boeing's manager for the tropo-scatter antenna program, said that the company has invested 100,000-dollars in the design work. Problems of heavy winds and rains to which the antenna might be exposed were considered. Thus the antenna's structural members are of hot-dipped, galvanised steel and, depending on maximum wind expected at the antenna site, can be reinforced to withstand hurricane forces of 180 miles per hour. The antenna will also survive temperature extremes from 70 degrees Fahrenheit below zero to 140 degrees above zero.

The second design represents a completely different approach. Intended for the "30ft and under" variety, it seeks to overcome many of the problems associated with metal reflectors by casting this vital component in fibre-glass. It is claimed to hold its shape under extreme temperature and weather conditions.

The new reflector is designed for extremely accurate focusing of radio waves. Antennas made with these reflectors could be used to measure radiation from other planets, to track satellites, and to transmit and receive long-range communications.

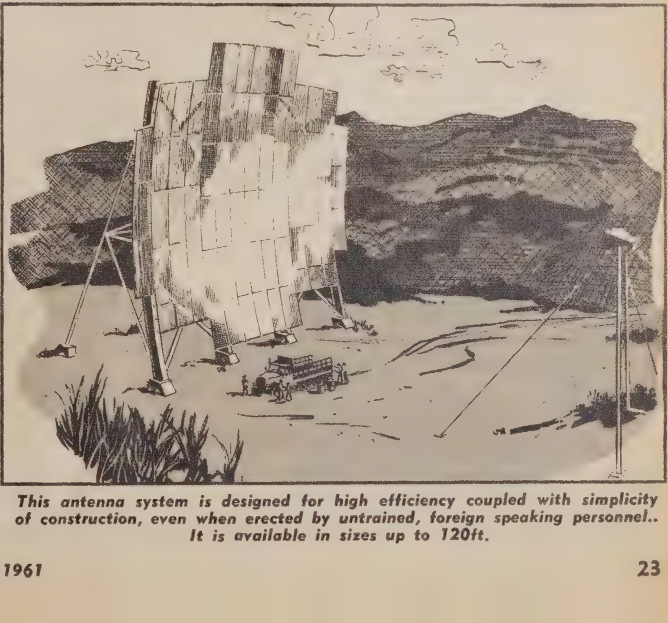
Richard Rheinhold, chief of antenna structural design, says that a precision fibreglass dish can be made to hold a surface tolerance of plus or minus .005 inch.

The smooth face of an antenna reflector is as important in focusing radio waves as a smooth-surface lens in focusing a camera. In fact, visible light is a form of high-frequency radio waves. Dents or deflections in an antenna reflector would be comparable to pock marks in a lens, and would limit severely the fineness of the focus.

The antenna dish gathers radio waves and reflects them in a concentration on a receiver probe in the centre of the dish. This greatly increases the strength of the signal received, in much the same way as a magnifying glass can focus sunlight on one spot in such strength as to burn.

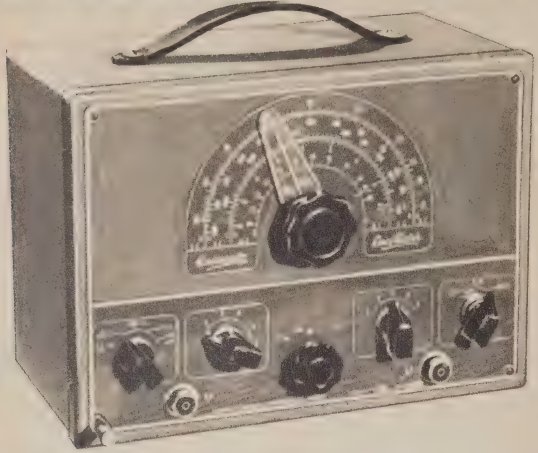
Some of the difficulties in designing a near-zero-deflection reflector are that conventional sheet metal requires costly support for its weight and stretches and warps under direct sunlight, severe cold and high wind pressures. Large sheet-

(Continued on Page 127)



This antenna system is designed for high efficiency coupled with simplicity of construction, even when erected by untrained, foreign speaking personnel.. It is available in sizes up to 120ft.

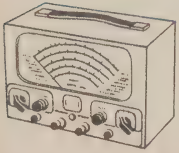
UNIVERSITY INSTRUMENTS



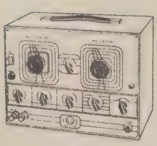
OSCILLATOR MODEL YOA

Model YOA Oscillator is a carefully designed precision instrument which is ideal for Radio Service use, receiver alignment and general experimental work. Finished in grey with black and silver panel, it is of attractive appearance and gives professional standing to any workshop or laboratory. Features such as vernier or fast dial drive, "spot" tuning, RF amplifier stage, new attenuation method, improved shielding, all contribute to make this Oscillator an outstanding University product. Provided with each Oscillator, without extra charge, are valves, shielded output leads, dummy aerial and instruction book.

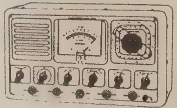
OTHER INSTRUMENTS IN THE COMPREHENSIVE "UNIVERSITY" RANGE



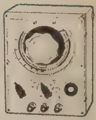
ELECTRONIC VOLTOHMMETER TVR/EV
This smartly styled large-scale Electronic Voltohmeter, although designed especially for servicing television receivers, will also test and align A.M. or F.M. receivers, measuring AVC grid bias and screen grid voltage in high-impedance circuits.



TELEVISION ALIGNMENT GENERATOR TVR/SM
This University instrument is the ideal signal source for precision alignment of TV and F.M. receivers. Model SM combines both a precision marker generator and sweep oscillator in one convenient metal case.



SUPERTRACER MODEL AST
A labour-saving and money-making instrument for any radio workshop. It is a modern, highly efficient signal tracer, and fault finding is speedy and easy with the AST. The University Supertracer will detect a host of radio faults.



RESISTANCE CAPACITY TESTER MODEL UBA
This instrument is designed for the measurement of an extensive range of resistances from 0.1 ohm to 10 megohms and capacities from 10 UUF to 10 UF. The UBA is sensitive and OVERLOAD PROOF.

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TAS.—W. P. Martin and Company, 188 Collins Street, HOBART, and 134 Cambridge Street, LAUNCESTON.
W.A.—Atkins (W.A.) Limited, 894 Hay Street, PERTH.

UG/FP.55

SCIENTIFIC & INDUSTRIAL NEWS

NEW ANTIVIRAL AGENT

INTERFERON, a newly-discovered substance manufactured inside the living cell, may soon become as important in the treatment of the virus diseases as the penicillins and other antiobiotics are today in curing diseases caused by bacteria.

Interferon acts against a very wide range of viruses, including probably all those which cause nose and throat infections.

It does not appear to be toxic to cells, even when administered in very large doses.

It does not stimulate the production of antibodies and thus unfavourable reactions against its protective effects, and it should be possible to use frequent doses.

Its effectiveness has been proved, not only in the test tube, but also on animals, and it has cured virus infection in rabbits and mice.

The phenomenon called "virus interference"—now known to be due to interferon—was recognised some 25 years ago in the laboratory.

A milestone was reached in 1943, when it was demonstrated that heat or ultra-violet light could be used to kill viruses and yet that they would retain the ability to interfere with the growth of others.

Step by step, evidence was growing that some substance was being produced —for instance, where mild viruses were endemic in a population—which prevented more harmful ones from gaining a foothold.

This brings us to 1957, the year of Dr Isaac's conclusive experiments. While examining the effects of heat-killed influenza virus on living cells, he unexpectedly found the answer to the virus interference problem.

Some hours after treating a cell culture with the dead virus, he found that the liquid in which the cells had been living had acquired a property which enabled it, when mixed with fresh living cells, to give these resistance to infection by many different viruses.

This property could only be due to a substance manufactured by the living cell to protect itself against virus attack. The substance was soon isolated, named and recognised as a member of the protein family having molecules as large as those of haemoglobin.

[Medical Research Council, 60 Buckingham Palace Road, London, S.W.1, England.]

ELECTRIC VEHICLES

A LEADING British manufacturer of electric battery road vehicles recently demonstrated at the London Dairy Show what they claim as a revolutionary development, which will outdate most of the 40,000 electrical road vehicles now operating.

The company's new Transitruck, which will be built from November in a new 130,000 square feet factory, incorporates for the first time a transistorised semiconductor method of control through silicon-controled rectifiers.

This eliminates the losses in resistance-started machines and results in stepless, smooth operation.

The development was carried out in collaboration with an electronics firm which will manufacture the specialised control and charging equipment under Sevcon Engineering, a specially formed company which holds world patent rights.

The basic price of the new vehicle will be £888.

[Smith's Delivery Vehicles, Gateshead, Durham. Joyce Loebl and Company, Team Valley Estate, Gateshead, Durham.]

MINIATURE LAMPS

THE first major advance in incandescent electric lighting since the introduction of the coiled coil in the 1930s is claimed for a new miniature iodine filament lamp now being manufactured in Britain. It enables very small lamps to be made up to the highest powers which, it is said, can provide better lighting more cheaply.

First application of the lamps is to flood-lighting for aviation, industrial sites, factories, and sports meetings.

Other forms of the lamp being developed are 500, 1,000 and 1,500 watt tubular lamps for floodlighting, the longest of which is only nine inches, and a tiny 100 watt lamp no bigger than a Christmas tree light for use in new, smaller designs of home movie projectors.

These mini-lamps, enclosed in quartz, are more robust and resistant to shock and vibration hazards and to atmospheric exposure than conventional lamps.

[General Electric Company (Osram Lamp Division), 296 High Holborn, London, W.C.1, England.]

U.V. TV CAMERA

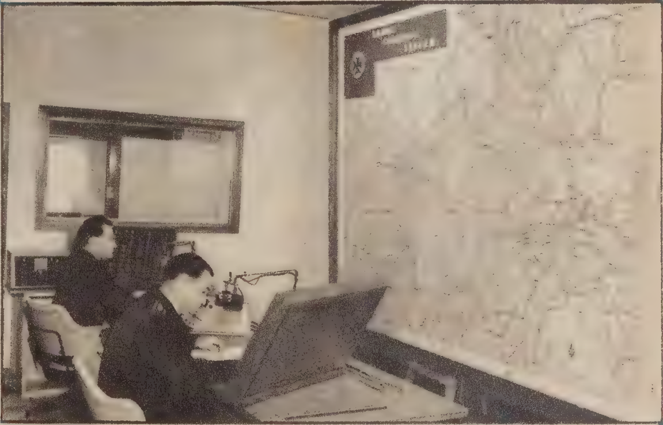
DIRECT observation of fundamental life processes has been brought a long step nearer by the development of a television camera tube coupled with a microscope that can operate on relatively weak ultra-violet light.

Normally, an ultra-violet microscope is used to take large numbers of photographs with different settings of the controls, to ensure that some pictures of cell details in animals or plants are in focus.

But high intensity ultra-violet soon kills these cells, while it takes time to develop and print photographs, some of which may be out of focus at vital stages of the cells' activities.

The new ultra-violet TV tube is so

NEW AMBULANCE RADIO SYSTEM



ABOUT 26 years ago, Sydney's Central District Ambulance System became the first Australian ambulance organisation to make regular use of two-way mobile radio. The service has kept progressively abreast of developments, and has now installed the most modern system in Australia.

The installation is part of the new Central District Ambulance headquarters in Quay Street, off Railway Square. It includes a 50-watt transmitter in the clock tower at Central Railway Station, immediately above the clock, with the aerial at the top of the tower flagpole.

The latest equipment, like the earlier ones, was supplied and installed by Amalgamated Wireless (Australasia) Ltd. It is small, streamlined, and capable of satisfactory operation over a wide area at all times.

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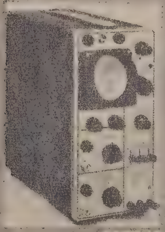

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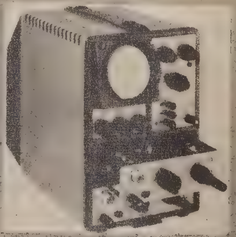

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(MA4744)

sensitive that the amount of light can be reduced to a level which leaves the cells unaffected for a considerable length of time. Observation is immediate and continuous and a specimen can be examined in breadth, width and depth simply by moving the specimen stage and focusing the microscope through the depth of the specimen, just as in an ordinary light microscope.

Speed is a major feature of the new device and in one hour a range of specimens can be examined that would take several months by other methods.

[E.M.I. Electronics Limited, Hayes.]

HARD METAL COATING

THE pre-industrial stage has been reached with a process giving a dense, ductile coating of nickel 5-1,000th of an inch thick by deposition from nickel carbonyl and the diffusion-bonding of the metal deposited to the protected metal at 600-650 degrees Centigrade. The result is stated to be far better than electro-plated metal.

Specially suitable for the protection of reactive metals and of small components for electronic equipment, rocketry, etc., made of less resistant metals, the technique has been extended with success to coating with molybdenum and tungsten.

Still under study are methods to obtain coatings of tantalum, niobium, beryllium, vanadium, titanium and zirconium.

Meanwhile, vapour-depositing of tungsten from its hexfluoride at 650 degrees Centigrade, is a newly perfected method of obtaining a smooth, nonporous coating of the metal which will withstand temperatures up to 3,300 degrees Centigrade without melting.

[Patents Exploitation Officer, U.K. Atomic Energy Authority, 11 Charles II Street London, S.W.1., England. Allied Chemical Corporation, Department 91/S, 61 Broadway, New York 6, N.Y., U.S.A.]

STEEL CLOTH FABRIC

A METAL woven fabric so fine and close that water passes through it with difficulty is made of stainless steel. It is drawn into threads finer than human hair. These are woven into fabric whose use is for re-entry parachutes in connection with the space-research program. The fineness of the wire is such that a mile of it goes to each square foot of fabric.

This woven steel will stand up to a temperature of 1,500 degrees Fahrenheit.

Apart from re-entry into the atmosphere the fabric may find many other uses. It is, in effect, the chain mail of 1961.

[United States Steel Company, 51 Newark Street, Hoboken, New Jersey, U.S.A.]

FODDER GRASS

A NOVEL development of fodder grass is of immediate importance to Britain and Europe and may well eventually prove important in many parts of the world.

The new fodder grasses, so far all rye-grasses, have the general range brand name of Tetra. This indicates the source of the increased yield of grass, for the word is short for tetraploid, meaning double the usual number of chromosomes in the nuclei of the cells. Common rye-grass is diploid and has twice seven chromosomes. The new varieties have four times seven.

The doubling of the chromosomes was achieved by immersing germinating seeds of diploid rye-grass in colchicine. This is well known as a growth promoter and has been used to produce bigger garden plants and bigger beets, but this is the first time it has been used sucessfully for grass. Once the tetraploiding is achieved, the rest of the development is careful plant breeding to retain the tetraploid advantages and get grasses with desired characterists in relation to resistance to cold, etc. It has taken nearly 10 years of development.

An increased dry-weight yield of up to 50 per cent is claimed. Seeds of the Tetra range—Tetrone, Italian rye-grass and Billion, a Westerwolds rye-grass—are more expensive and have to be sown rather more intensively. The plants, however, grow bigger and lusher and withstand several cuttings per season. They resist leaf diseases and give more palatable leaves.

[W. W. Johnson and Son, Boston, Lincolnshire, England.]

BRIGHTER FINISHES

THE lustre of electrolytically deposited metal coatings can be considerably improved and subsequent polishing rendered unnecessary, it is claimed, by adding to the plating bath a new compound developed by a German concern.

The compound—a water-soluble salt—can be added to either an acid or an alkali bath and is specially suitable for the plating of copper, zinc, cadmium, tin, silver or gold. The product is easily dissolved but is used up only slowly, according to the company.

[Deutsche Hydrierwerke G.m.b.H., 67 Henkelstrasse, Dusseldorf, Germany.]

MOISTURE PROOF SHEETING

THIN films of a new plastic material belonging to the family of fluorohalocarbons, which includes the well-known extra-tough P.T.F.E. (polytetrafluoroethylene), are now on the market.

Their main characteristic is a fantastically high resistance to the passage of water vapour. To obtain the same effect with a sheet of polyethylene, this would have to be 400 times as thick, while a polyester sheet would have to be nearly twice as thick again.

An immediate use is the packaging of electronic and other delicate equipment which must be kept absolutely dry, as well as of moisture-sensitive antibiotics, drugs and chemicals.

[Allied Chemical Corporation, Department 91/S, 61 Broadway, New York 6, N.Y., U.S.A.]

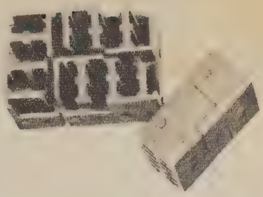
PROTECTIVE TAPE

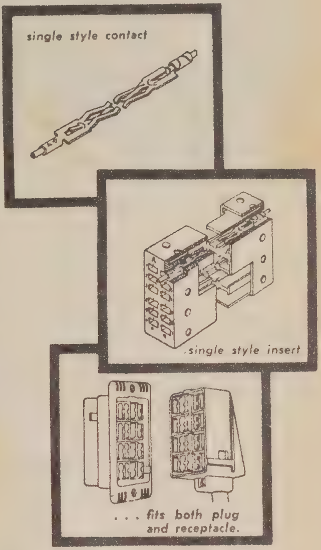
INTENDED to protect motors and wires from heat damage, a heat-reflecting tape combining aluminium and glass fibre has been produced in America.

It is claimed to be able to withstand 600 degrees Fahrenheit in continuous service or intermittent radiant heat up to 3,000 degrees.

The tape, held in place by silicone adhesive, is only .006 inch thick.

[Minnesota Mining and Mfg. Company, 900 Bush Avenue, St. Paul, Minn., U.S.A.]





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The unique hermaphrodite-modular design of Cannon's new MORPHO lightweight plugs provides unusual flexibility and versatility! Especially intended to meet commercial applications such as computers, business machines, and communication equipment inexpensively and with complete reliability—these unusual plugs are equally well suited for many military requirements. The MORPHO line features hermaphrodite crimp type contacts and hermaphrodite modular insulators which fit both plug and receptacle. Currently available in 12, 24, and 36 contacts . . . allows numerous alternate insert positions.

For further information write to RTH.21.

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CANNON ELECTRIC

Building Your Own ELECTRONIC ORGAN

Your completed basic organ will look like this. For use in churches, halls or large rooms, an additional remote speaker cabinet can be used to advantage. Again, if a deep-bodied stool is provided it can house record-playing equipment coupled to the organ's amplifier system.

As foreshadowed last month, we present here the first article of a series describing in detail the construction of a modern, fully electronic organ, well suited for use in the home or in small to medium-sized churches. It represents our most ambitious project to date but it is one which you can undertake with full confidence. It won't involve you in an impossible amount of work but it will provide you with endless pleasure when completed.

By Neville Williams

THE background to the project we gave you last month.

In brief, we have long had a personal ambition to build an electronic organ, and equally, to describe such an instrument in these pages as a guide to interested readers. But it's one thing to have an ambition; quite another to see it fulfilled.

Like many other would-be organ builders, we've gradually collected and stored paraphernalia that could be used for such a project, without ever summoning sufficient courage actually to make a start.

Instead, viewing the enormous amount of work in building an organ "from the ground up," we'd just about accepted the idea that it was beyond our resources in terms of spare time; that if we were going to have an organ, it would have to be a bought one!

And there the matter rested, more or less, until talks with Messrs Stromberg-Carlson (A'sia) Pty. Ltd. revealed the possibility of them making available their current model single-manual organ as a build-it-yourself kit.

Examination of the organ, with this in view, showed it not only to be suitable but almost ideal, for the purpose. Manual, Control Panel, Tone Generator, Pedal Clavier and Amplifier are all entirely separate units, which can be individually purchased, handled and, later, connected together with a minimum amount of cabling.

And, even when complete, virtually every part remains immediately accessible through the top lid or rear of the console. Repairs, tuning, adjustments and experiments can all be undertaken without undoing a single wire or rendering any part of the organ inoperative.

The console itself and the playing stool which is available to match, are both beautifully finished, and in a variety of tonings. Availability of such a console is an automatic guarantee that the finished instrument will have eye appeal as well as ear appeal!

And ear appeal it certainly has. Though relatively simple, as electronic organs go, and priced at little more than half what you would otherwise expect to pay, it has a dynamic and tonal range which will ensure its acceptance in any home or small to medium-sized church. And, if you want to add later to the basic organ, the facilities are there to do it.

Having thus been intrigued by the possibilities of the organ as a build-it-yourself project, we went into the whole matter very thoroughly with Mr Neville Oates, engineer in charge of Stromberg-Carlson organ development, and also Mr Bob Swan, organ sales superintendent for the company and, himself, a qualified organ builder and player.

We discussed possible constructional problems, marketing approach, presentation, etc., then took the obvious next step. Putting ourselves exactly in the position of a home-builder, we set to work and made up a complete organ in the home, in spare time, and using only hand tools.

WITHIN A MONTH

And, as we said last month, we had it built, tuned and playing within a month. Maybe you won't want to work that fast, but our effort was designed to show what could be done, while still having enough time to eat, sleep, go to work and mow the lawns!

We have ideas about adding other facilities to the organ, but our first and prime task is to describe the construction of the basic instrument.

Before we do, however, we had best give you a run through the design and specifications in more technical terms. Having—we hope—read last month's general article on the whole subject, you shouldn't have any great difficulty in following what we have to say.

The Stromberg-Carlson organ uses a single 49-note, 4-octave F-F manual, with an optional but highly desirable octave of bass pedals.

Selection and control of tone colours is achieved by the use of rotating knobs controlling modified radio-type potentiometers. These cannot be flicked on and off with the ease of conventional organ tabs but they do give a complete range

Modifications

To minimise confusion with Service Data and the manufacturer's construction kit, the circuitry as specified conforms closely to that used in the factory-built model.

However, based on our experience in building and using the organ, we have been able to suggest certain modifications, which individual constructors may incorporate or ignore, as they see fit.

The nature of the modifications is fully explained towards the end of the article and intending constructors should study them before wiring the relevant portions of the circuit.

The modifications have all been discussed at length with Stromberg-Carlson engineers and have their approval. However, they are not provided for in the construction kit and it is the responsibility of individual constructors to provide the necessary additional items themselves. In practice, only a few shillings' worth of components is involved.

of control between fully off and fully on.

Tone colours available via the potentiometer controls are labelled "Diapason," "Reeds," "Flute," "Strings," "Horn" and "Oboe." They can be used separately or mixed at will to give a wide variety of tone colours.

Other controls, similarly styled, include "Pedal Volume," a particularly effective "Vibrato" and two rotary switches.

One of these latter changes the whole manual over from the selectable tone colours to a so-called "Full Organ" tone. The other grades the manual for level overall output or for accentuation of either right or left hand. Used in conjunction with the tone selection potentiometers, it allows an experienced player to play a dominant solo on either hand with a distinctive accompaniment as would otherwise require a second manual.

Overall volume is controlled by a conventional balanced foot pedal.

The pedal clavier, providing one C to C octave, uses radiating pedals, anchored beneath the console but long enough to permit normal heel-and-toe operation. The pedals are served by a single oscillator, which produces output appropriate to the pedal depressed. Since it is normal to play only one note at a time in an abbreviated pedal clavier, the economy represented by a single oscillator involves no sacrifice in performance.

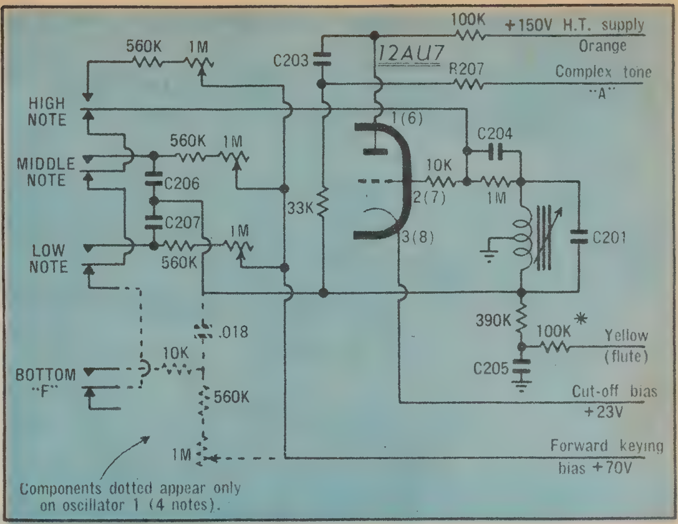
Normal practice is to provide the organ with an in-built 12-watt amplifier, which also provides regulated supply voltages for the tone-generating circuits. Sound is radiated through the front grille by a medium-priced 12-inch speaker, selected to have a cone resonance just clear of the bass notes produced by the pedal clavier.

SPEAKER, PHONES

Facilities are provided, however, for operating a remotely placed high-quality speaker system or, conversely, for listening only through earphones. It is thus possible for a player to practise without any sound being heard by other persons.

Space exists in the console for the provision of an additional amplifier, possibly used in conjuction with a reverberation unit. Space is available also on the front control panel for whatever additional controls individuals may deem desirable.

A commendable feature, from the domestic viewpoint, are the modest overall dimensions of the console. It is 40¼ inches wide, 34 inches high and 23 inches deep. Since this latter figure includes the pedal clavier, which does not protrude any further than the keyboard, there is no problem in carrying the instrument through a standard doorway. It can be carried easily by two people.



Here is the basic electrical circuit to which the oscillators are wired. Values of the coded components, as well as the inductor, vary from one oscillator to the next and are set out in a table elsewhere in the article. The 100K resistor marked with an asterisk is the subject of a suggested modification.

As distinct from the organ function, it is a simple matter to mount a record-playing deck in the stool or elsewhere, using the organ's amplifier and loudspeaker system, for high-quality reproduction from records. Switching and volume for this purpose can be controlled, if desired, by a switch-pot. at the right-hand end of the control panel.

Basic tones in the Stromberg-Carlson organ originate in a "Tone Generator" chassis running the length of the organ and mounted vertically behind the keyboard. Valves and tuning arrangements are immediately accessible from the rear of the console, while the tone generator chassis can be slipped off its mounts and supported underside-up for attention to the wiring or small components, without rendering the unit inoperative.

Consistent with the relatively low price of the organ, either as a kit or a complete instrument, the generator unit is essentially simple, both in design and construction.

Eight 12AU7 valves are involved, providing sixteen triodes. Each is wired as a Hartley oscillator, generating audio tones directly, in association with an iron-cored inductor with adjustable air-gap.

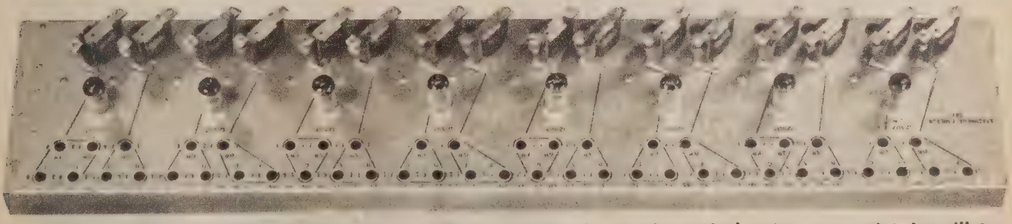
Each oscillator, in turn, serves three adjacent notes, except one, which serves the four lowest notes on the manual. This scheme effects a very large economy in components and wiring and is justified by the fact that normal playing seldom calls for adjacent notes to be sounded together.

Wiring to the keys is arranged so that, should adjacent notes be so played, served by the one oscillator, only the higher one sounds. In practice, anyone playing the organ soon learns quite automatically to avoid runs which end in adjacent notes or to transfer such runs to another octave.

OSCILLATOR INDUCTORS

The basic frequency of each oscillator is chiefly dependant on the setting of the inductor—five basic types are used—and the value of the capacitor with which it resonates. Variations therefrom, to approximate the adjacent notes, are secured by bringing in additional capacitors, while exact tuning of all notes is achieved by adjusting potentiometers which are also introduced into the grid circuits by the key switched.

The oscillators are normally held at cut-off by a positive voltage applied to their cathodes. Depressing any playing key applies a positive voltage to the grid of the appropriate oscillator, allowing it to function. This system of keying avoids many of the leakage and cipher-



A top view of the tone generator chassis, showing the eight double triodes and the sixteen associated oscillator transformers. The holes give access to the forty-nine tab-type pots used for fine tuning. Note how the chassis markings identify each note and associate it with a particular valve and transformer. In the console, the Tone Generator chassis mounts vertically on cleats, with the pots at the top and the notes progressing in the same order as the playing keys.

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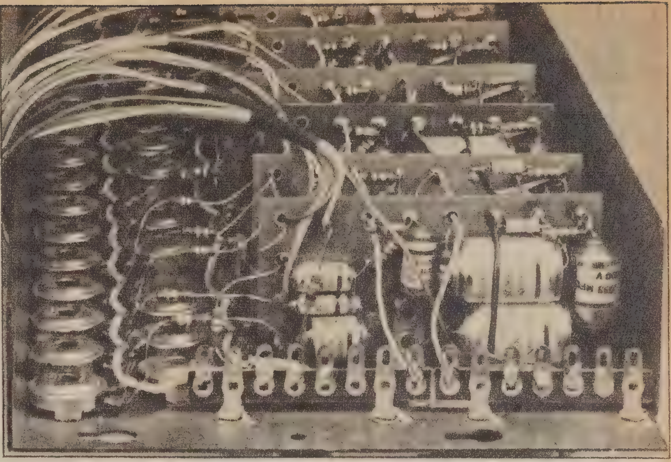
ing troubles which accompany continuously running oscillators, minimises contact problems and also produces a more natural attack and decay characteristic.

As we shall see in more detail a little later, two outputs are taken from each oscillator—a near sine wave to provide the "Flute" tone and, a distorted pattern from which the various imitative voices are created.

To create these voices, a formant filter system is used, involving two inductors and a variety of resistors and capacitors, all mounted behind the same Control Panel which accommodates the Tone Section Potentiometers. Cables connect the Control Panel to other sections of the organ.

Blocking bias, keying voltage and supply voltage for the oscillators is all derived from the main power amplifier and supply unit, voltage regulation being employed to ensure stability of output, despite possible variations in mains voltage.

However, provision is made to modulate the oscillator keying voltage at a low frequency date, to give a vibrato effect. The vibrato rate can be pre-set fast or slow and the vibrato depth varied, at will, from the Control Panel.



A close-up view of the end of the Tone Generator showing the tagstrips which terminate the cables and the board for oscillator 1—the lowest frequency unit. Capacitors on the higher frequency oscillators become progressively smaller. Note the flying leads ready for connection to the manual.

WHERE TO START

Such then are the features and characteristics of the organ which we now present for home construction.

Where does one begin?

Well, we tackled first what seemed to be the "heart" of the instrument and the most onerous task—construction of the Tone Generator unit, pictured on these pages.

The chassis involved measures 36 x 7¼ x 2 inches, plated underneath to allow connections to be soldered directly to it. This is a factory technique which you should be able to follow if you have a Scope iron or other type with sufficient heat output. Use resin-cored solder for the whole job, avoiding the use of chemical pastes.

Well then, let's to it!

First job is to mount the 49 tab-type potentiometers, which will ultimately provide the tuning for individual notes on the manual. Tab types are used for the sake of economy. Mounting simply involves pushing them into position, gripping the end of the small tabs which come through the chassis, with bull-nose pliers and twisting through something just under a right angle. But take it easy, or you will tear the tabs right off!

Note that the pots. should be 1-meg. A-taper (i.e. linear) units, mounted with the lugs towards the centre of the chassis.

One outer lug on each pot. needs to be linked in a common circuit. The easiest and neatest way to do this is to twist the appropriate lugs slightly, so that a length of tinned copper wire can be threaded straight through, along one line of pots, then back through the other.

Cut and thread short lengths of "spaghetti" tubing (use cambric not plastic) over the wire between the lugs, allowing for a slight bow in the wire to clear the other lugs. Spot solder each intersection, using resin-cored solder and preferably avoiding any chemical flux.

Passing the wire through the lugs in this fashion may complicate slightly the job of replacing an individual pot., should this ever become necessary, but the initial cleanness of the method is worth the slight risk involved.

Wiring the pots, as shown will ensure that clockwise rotation, with the chassis in situ, produces an increase in note frequency.

Next job is to mount the valve sockets which, in the prototype, were low-loss moulded types, mounted above chassis. The blank space between pins 1 and 9 faces, in each case, away from the line of potentiometers. Using a "Scope" or other iron equal to the task, run a short length of tinned copper through the space, from the centre spigot to the lead-coated underside of the chassis.

The suggested orientation of the sockets allows two runs to be made through the heater pins and on to the terminal strip at the end of the chassis.

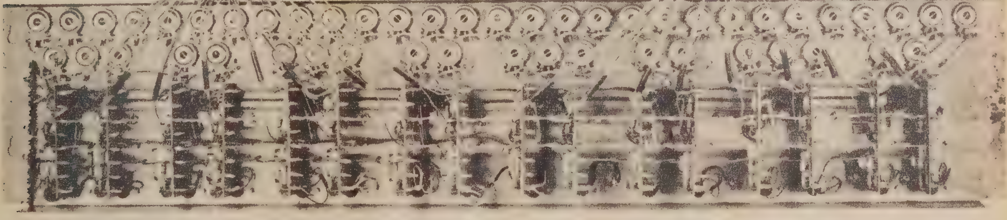
One length of tinned copper runs straight through all the pins 9, which can be slightly twisted for the purpose. Another run passes through all the pins 4 and 5. Slip a length of cambric spaghetti over the wire between sockets, allowing just enough slack so that it can be pushed down against the chassis.

All cathodes have to be joined in similar fashion, though this is complicated by the fact that the pins are not in line and the need to dodge around the spigot. However, a neat job can still be done, using shorter lengths of flexible tinned copper and pieces of cambric spaghetti to suit. This run also terminates on the tagstrip at the end, as indicated.

TWO TAGSTRIPS

Two 8-tag strips are required to terminate the cables. In the original organ one of these is trimmed to 7-positions to give more clearance from the adjacent potentiometer but, in the light of a modification suggested at the end of the article, involving one extra wire, there would be some point in trying to retain the two complete strips.

Mount the tagstrips in line with the sides of the chassis, so that they will not foul the cleats in the cabinet, against which the chassis has ultimately to be mounted. Further, to facilitate mounting, solder the strips in position. The bolts which are discernable in the close-



We included this underneath photograph mainly to give you a general idea of what the underside of the finished Tone Generator chassis looks like. Plate and grid leads should come off the front or back of the boards, depending on their position relative to the relevant valve socket. Be careful to see that the resistors for the "High," "Low" and "Middle" notes connect to the appropriate potentiometers in each group, as marked on the reverse side of the chassis. The group of wires attach ultimately to the key board contacts.

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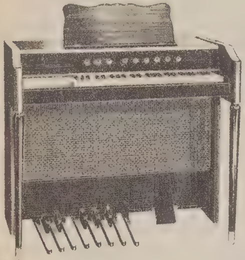

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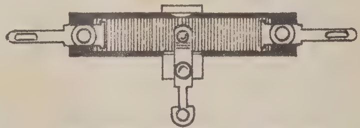

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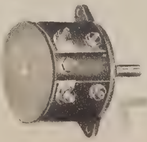

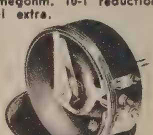

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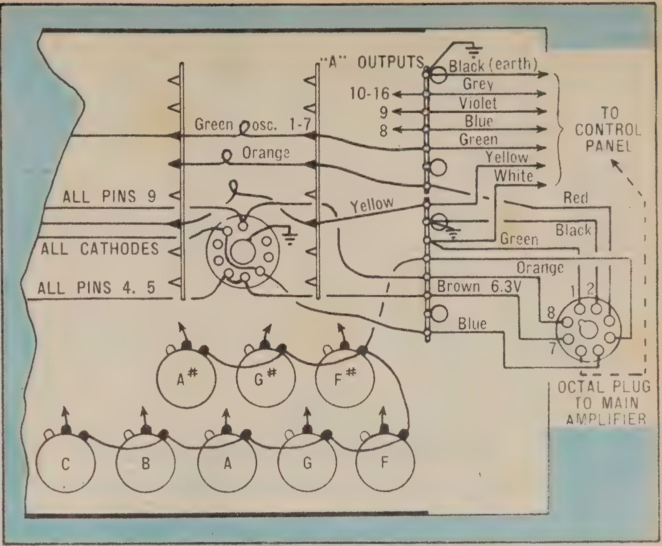
up picture, had to be removed, for this reason, in the prototype instrument.

The connections and colour coding suggested in the diagram are the same as used in the production model of the organ—a simple precaution which will ensure that any literature you may acquire relative to the latter will also apply for your own instrument.



This wiring diagram shows the essential connections and the colour codes for the tagstrips at the end of the Tone Generator chassis. Connections are also shown to the adjacent oscillator boards, the tab pots and the first oscillator valve socket. The dotted lead to pin 6 relates to a suggested modification.

Next job is to mount the oscillator inductors, using either self-tapping screws or small bolts. There are five varieties of inductor, differentiated by the colour of the leads representing the outer ends of the winding.

MOUNTING THE INDUCTORS

The two inductors serving the lowest notes in the manual have brown leads; these mount at the same end of the chassis as the tagstrips just discussed. Then follow in order three with red leads, four with yellow leads, four with green leads and three with blue leads. When mounting the inductors, pass the leads down through the appropriate holes in the chassis, using small grommets for physical protection.

This brings you to what is probably the most tedious task in the whole project—wiring the 16 oscillators. A lot of small wiring parts are involved here and it is most important to use the exact values and to at least the tolerances specified. Use only plastic capacitors, these having proved in service to have stability adequate for the purpose.

The point behind this statement is simply that, while one may be able to "get away with" other values and types, the prospect of having subsequently to dismantle and fiddle with all or any of 16 oscillator wiring boards is not a very inviting one.

Here again, our diagram largely duplicates that used for the production instrument, including the colour coding of the trailing wires. Colour coding is almost necessary, anyway, in a job like this and it is a lot easier to follow a code which has been worked out, than to start inventing a new one in quite arbitrary fashion.

All oscillator boards are similar in configuration except for the one serving the four lowest notes on the manual, which has one extra keying circuit, as shown dotted. While the wiring configuration is otherwise the same, however, component values vary and close attention should be paid to the table which sets out all the relevant information in the form you will need.

NEED FOR CARE

The moral here is to be careful in the first place, then check and double-check before the boards are finally soldered up and mounted into the chassis.

The assembly boards are of a type which are designed primarily for dip soldering, but they are nevertheless quite convenient for hand working. Simply bend the component leads as necessary and push them through the appropriate holes, at the same time stripping and adding short connecting leads as indicated on the diagram. The resistors can be kept clear of the board by about a ⅛-inch to minimise unnecessary heat and stress.

When the requisite number of leads are in position, hold the iron tip against the body of the cone-shaped receptacle, touch the resin-cored solder on to it and you will find that the solder will flow into the receptacle completely surrounding the wires.

Having ensured that all is well, clip off the surplus leads and the oscillator board is ready to mount—or almost so.

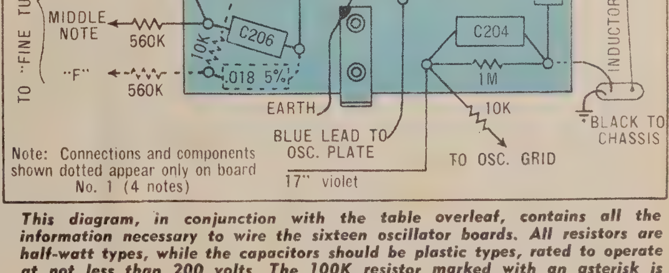
We suggest that you complete first the board serving the four lowest frequency notes, mounting it adjacent to the tagstrips and wiring it thereto according to the diagram.

The remaining oscillators can then be assembled, one at a time, mounted in position and wired into the main chassis. The inductor leads are not polarised so that it is merely necessary to spot the centre-tap to the chassis and connect the ends, either way round, to the appropriate connections on the board.

Each board associates naturally with one triode section, so that there should be no doubts on this score. Note that each grid connects to its board via a 10K ½W resistor. To obviate the possibility of this component fouling another connection or the chassis, it is suggested that a scrap of large diameter nylex tubing be slipped over it, long enough to cover the resistor and the leads as well.

The resistor attaches logically to one side or the other of the board, depending on the relative position of the valve socket. If you watch this point, you can put it in the right position before filling the lug with solder.

The supply lead, and that carrying the "Flute" tone, loop straight across from board to board and thence to the tagstrip at the end of the chassis. The



Note: Connections and components shown dotted appear only on board No. 1 (4 notes)

This diagram, in conjunction with the table overleaf, contains all the information necessary to wire the sixteen oscillator boards. All resistors are half-watt types, while the capacitors should be plastic types, rated to operate at not less than 200 volts. The 100K resistor marked with an asterisk is the subject of a suggested modification.

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connections can be made progressively as you add the boards.

Note, however, that the complex tone, taken from point "A" on each board, is subdivided into groups to allow the relative level from the ends and middle of the keyboard to be changed. Thus, there are separate leads from oscillators 1-7, 8, 9 and 10-16.

Three (in one case four) 560K resistors anchor to one end of each of the boards, the intention being that their free ends attach to tab pots serving as the fine frequency adjust of the particular note on the scale.

Do not trim the pigtails attaching to the board otherwise you may end up with insufficient length to bridge the gap. If there is overall length to spare, trim it off the end attaching to the potentiometer—after you have made up your mind where the resistor terminates.

In wiring the 560K resistors to the potentiometers, do not take the position of the potentiometers for granted, as viewed from the rear.

Identify each group serving the one oscillator, from markings on the outside of the Tone Generator chassis and, if there is any likelihood of confusion, mark the pots internally with "high", "middle" and "low". There will then be no doubt where each resistor on the board attaches.

With a little care, you will find it possible to have the bodies of the resistors running parallel or at right-angles to the chassis, which will maintain an air of orderliness. As we mentioned earlier, any surplus pigtail can be clipped off at the potentiometer end, after the position of the resistor has been worked out.

From each board also, you will have four (in one case five) trailing leads, some 16 inches long. These are for ultimate attachment to the keyboard but, in the meantime, they can become something of an embarrassment as you try to handle the generator chassis.

We suggest that, as each board is completed and mounted, two one-inch lengths of 5-mil. nylex tubing be slipped over the group of four (or five) wires, one piece of tubing close to the board, the other nearer the end of the wires. The violet wire, by the way, is best brought up between the orange wires and the "A" lead, to ensure a more direct run to the rear of the keyboard.

Used in conjunction with the diagram on the preceding page, this table sets out the value used on the sixteen oscillator boards. In same cases, capacitor alues may be made up and supplied as two capacitors connected in parallel and suitably marked.

For the time being, the groups of wire can be held together in two bunches with a couple of rubber bands. The colour coding will enable you to sort them out afterwards without any trouble.

The final job, after finishing and installing all the oscillators is to make up a cable running to an octal plug and plugging into an equivalent socket on the main amplifier. We suggest that the cable be made about 36 inches long. This is more than is strictly necessary to cover the intervening distance but it allows the amplifier or the tone generator to be moved out of position without interrupting any circuitry.

Make up the cable by running the wires as shown through 10 mil. nylex tubing and, for preference, use one of

KEY		OSC. BRD. No.	TRANS. CODE	C201 400V. 5%	C203 400V. 20%	C204 400V. 20%	C205 400V. 20%	C206 400V. 10%	C207 400V. 10%	R207 10%
No.	Name									
49 48 47	F E D#	16	Blue	.0039	.0068	.0082	.001	.00056	.0012	270K
46 45 44	D C# C	15	Blue	.0047	.0082	.01	.0012	.00068	.0015	220K
43 42 41	B A# A	14	Blue	.0056	.01	.01	.0015	.00075	.0018	220K
40 39 38	G# G F#	13	Green	.0056	.012	.012	.0018	.00075	.0018	180K
37 36 35	F E D#	12	Green	.0068	.015	.015	.0022	.00091	.0022	180K
34 33 32	D C# C	11	Green	.0082	.015	.015	.0022	.001	.0025	150K
31 30 29	B A# A	10	Green	.01	.022	.027	.0033	.0012	.0030	150K
28 27 26	G# G F#	9	Yellow	.012	.033	.033	.0039	.0018	.0039	150K
25 24 23	F E D#	8	Yellow	.015	.033	.047	.0047	.0022	.0047	120K
22 21 20	D C# C	7	Yellow	.018	.047	.047	.0056	.0027	.0056	120K
19 18 17	B A# A	6	Yellow	.022	.047	.068	.0068	.0027	.0062	100K
16 15 14	G# G F#	5	Red	.022	.047	.1	.0082	.0027	.0056	100K
13 12 11	F E D#	4	Red	.027	.047	.1	.0082	.0027	.0056	100K
10 9 8	D C# C	3	Red	.033	.1	.1	.01	.0047	.01	100K
7 6 5	B A# A	2	Brown	.033	.1	.1	.01	.0047	.01	82K
4 3 2 1	G# G F# F	1	Brown	.033	.1	.1	.012	.0047	.01	82K

the thicker varieties of hookup for the heater leads.

Seven leads are required according to the original design but a modification explained at the end of this article suggests the provision of an eighth lead to pin 6, which can provide a variable speed vibrato facility on the Control Panel. The wire does not need to be broken in the tone generator chassis though it could be allotted a tie point, similar to the wire from pin 1 of the plug, if a suitable tie point were available.

Another cable has to run away to the control panel, as indicated, but we suggest that this be anchored primarily to the control panel when this is constructed and the leads spotted on to the appropriate points in the tone generator chassis when the two are ultimately brought together.

Working solidly, you will find that it may take a week or so of evenings to complete the tone generator chassis, even assuming there are no hold-ups. Fortunately, it is "clean" and not unpleasant work and, with the completion of the particular chassis, you will have the largest single assignment behind you.

It would be possible at this stage to check the operation of the individual oscillators by applying suitable operating voltages from any source which happens to be handy. Whether there is much point is in so doing, if you are building the complete organ "at one go" is an-

(Continued on Page 39)

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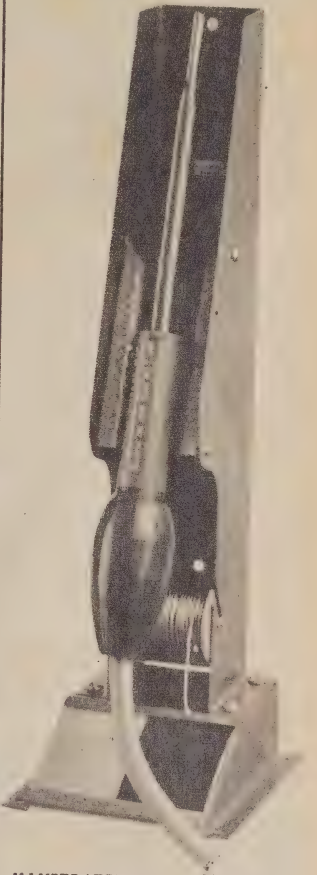

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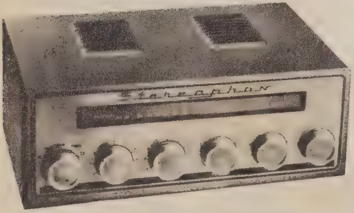

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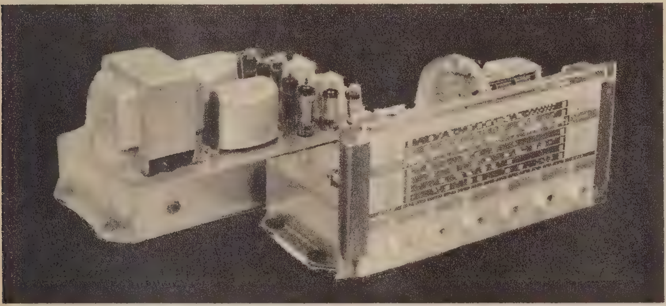

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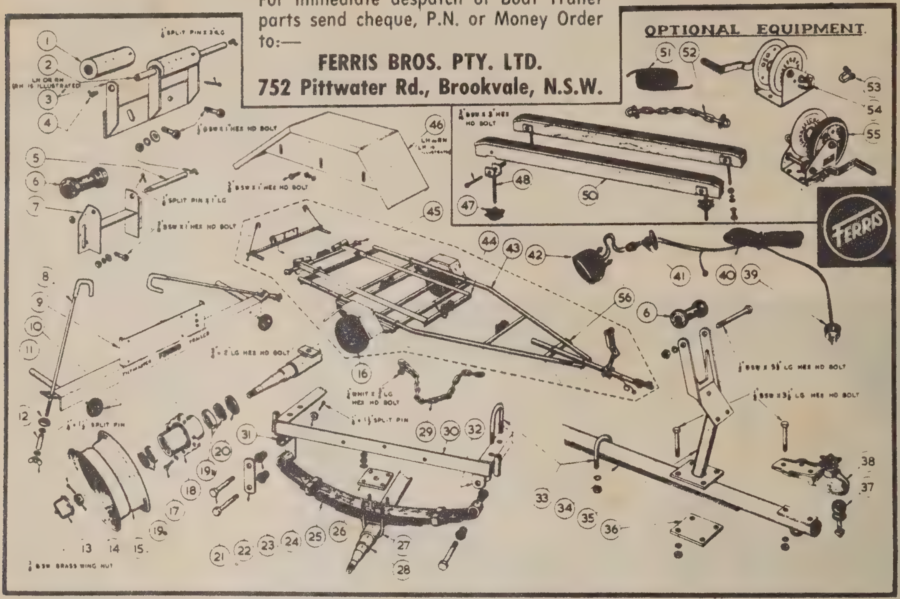

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other matter. Even in the console, the tone generator will always be readily accessible and minor corrections can be made without any great difficulty.

Our approach, therefore, was to check everything very carefully as we went along, keeping an eye out for possible shorts, dry joints, etc. The completed unit was then put aside, on the assumption that it could most easily be tested when it could ultimately be connected to the rest of the circuitry.

The point behind this remark is that the Tone Generator Unit, for normal operation, requires a substantial heater supply and three positive voltages quoted by the manufacturers as:

(1) 150 volts regulated for the plate supply.
(2) 23 volts, also stabilised, for the common cathode return and
(3) 70 volts, capable of modulation at vibrato rate, for the grid keying supply.

The main amplifier and power supply unit, yet to be described, provides these essential voltages, as well as the vibrato oscillator. If you plan to use existing amplifier and loudspeaker equipment with the organ, a supplementary unit may have to be considered to provide the missing facilities.

Be that as it may, the Tone Generator chassis represents the most complex unit in the whole organ and, when you have completed it according to the foregoing instructions, you will have the biggest hurdle behind you.

SUGGESTED MODIFICATIONS

As we indicated at the beginning of the article, we are suggesting certain modifications which can be effected at the discretion of individual constructors and which, in our opinion, improve the final result.

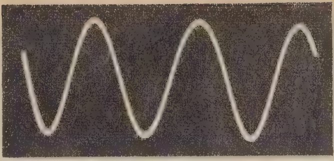
In playing the finished organ, our reaction was that the "Flute" tone was much too heavy near the left-hand end of the manual for ordinary playing techniques. Furthermore, the already high output from the oscillators in this region was likely to be augmented by resonance effects in the speaker and enclosure in the region of 100cps.

The Flute stop can be rendered much more pleasant and useful by reducing the amplitude fed from the lower frequency oscillators to the "Flute" line. It is also an advantage to brighten the treble end by a slight modification to the filter system in the Control Panel—a point which will be detailed next month.

The modification to the oscillator boards is, fortunately, very simple. Output to the Flute line is derived from the oscillator through two resistors (a 390K and a 100K) bypassed at their junction by capacitor C205. Object of this network is to attenuate the harmonics and produce a substantially pure sine wave.

Our suggestion is that the 100K resistors for oscillators 1 and 2 be increased to 330K, for oscillator 3 to 270K, for oscillator 4 to 220K, for oscillator 5 to 180K and for oscillator 6 to 150K.

Remember, however, that the objective is NOT uniform output voltage as observed on a meter or a CRO but uniform or suitably graded LOUDNESS, as judged by ear and using an adequate speaker system.



A typical waveform available from the "Flute" output of one of the oscillators. The complex waveform is much more angular and is not used directly, being subject to modification in the formant filter system, yet to be described.

A further suggested modification does not concern the circuitry of the Tone Generator chassis but it does involve the cables connected thereto. One of these cables runs to the main amplifier on the floor of the console, the other to the Control Panel above the keyboard.

As you will observe when you come to the circuitry involved, it is a very simple matter to provide a two-speed Vibrato facility by simply shunting to earth the active side of the Vibrato speed pre-set pot. in the amplifier. This can be done, in turn, by using a push-pull switch-pot. as the Vibrato control on the panel—the switch to give the fast and slow Vibrato and the Pot. element to vary Vibrato depth.

What is required is an extra lead running from the amplifier to the Control Panel. Fortunately, this can be accommodated with the existing leads via the Tone Generator.

When making up the lead to the amplifier, therefore, include a long piece of hook-up terminating in the now-vacant pin 6 of the amplifier plug. The lead does not need to be broken or terminated in the Tone Generator chassis but joins the cable running up to the Control Panel.

Where the lead connects will be explained in other articles but it is much easier to include it in the cables at this stage than have to pull it through later.

NEXT MONTH:

In our next issue, we plan to continue the series with a detailed description of the Control Panel, including the formant filter system. Compared with the Tone Generator unit, its construction is a relatively simple task. Also, if space permits, we shall be discussing the keyboard — a completely new product in Australia, using moulded plastic playing keys and a printed circuit contact system.

Wanted — "SPACE"

(Continued from Page 5)

high and will simulate outer space conditions up to 300 miles. Other RCA divisions actively participating in the Mark I project are the Electron Tube Division, with its experience in designing the C-Stellarator Vacuum System, and the Astro-Electronics Division as prime contractor for Tiros I and II.

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Here's your answer, Tom!

As promised last month, we are presenting the second part of the treatment of rotating electric machines. This article deals with the basic alternating current machines and discusses the operation of the alternator, the synchronous motor and the induction motor.

By JAMIESON ROWE

WE saw last month that a coil of wire revolving in a magnetic field generates an alternating voltage. Where a unidirectional voltage and consequent current are required, this voltage is usually rectified by the use of a commutator-and-brushes type of reversing switch mounted on the machine spindle. However, if alternating voltage and current are desired, it is usual to employ a simple slip rings-and-brushes system for current transfer.

The machine then becomes an alternator. The generating windings are usually multi-turn coils to provide the required output voltage and current, and the field excitation is provided by a direct current flowing in the field windings. Such machines vary in size from the enormous machines installed in network power stations (operated from steam turbines, water turbines or diesel engines, etc.), supplying many millions of watts, to tiny machines in low-frequency signal generators used to supply one or two watts.

Where large output currents are handled by an alternator, it is usual to have the armature (output) windings stationary, so that high currents do not have to be transferred via brushes and rotating contacts. In such a machine the field structure rotates and provides the relative armature-field motion necessary for generation. The excitation current is relatively small and is easily carried by brushes, etc.

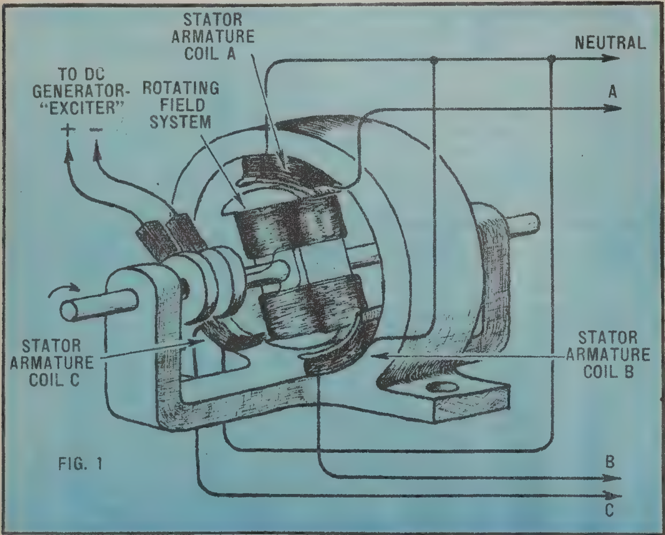
For high power machines, the output power is delivered from not one, but three systems of windings. The voltage generated in each coil system differs in phase from the other two in such a way that the three voltages are 120 degrees apart in phase. This is called a "three-phase" power system, and possesses the advantage that the size of conductors necessary to handle a certain amount of power is smaller than most other systems. It also allows rotating magnetic fields to be created easily for use in motors, as we shall see in a moment.

Such a three-phase alternator is shown in basic form in Figure 1, with the features of interest indicated.

As the turbine or engine rotates the field structure, its magnetic field rotates with it, and the armature coils on the stator experience cyclically reversing magnetic conditions. Thus they generate an alternating voltage.

There are two principal methods of connecting the three windings on AC machines, known as "star" and "delta" connections respectively. The machine shown in Fig. 1 is connected in star configuration, with one side of each winding in common connection with the others and termed the "neutral" line. This type of connection is shown diagrammatically in Fig. 2 (a). If all three windings and phases are equally loaded, no current flows in the neutral line, due to phase cancellation, and the fourth (i.e. neutral) wire is not actually needed.

The delta type of connection is shown in Fig. 2(b). Here the coils are connected end to end and there is no neutral point. The delta connection is rarely used for alternators because of this, but finds considerable application in motors and transformers.



This sketch shows a simple synchronous machine, having three-phase stator windings and a DC-excited rotating feild. It may be used as either an alternator or a synchronous motor, by suitably connecting it electrically and mechanically.

USED AS MOTOR

As might be expected from the parallel case concerning DC machines, the alternator may be used directly "as is" as a motor, and becomes the synchronous motor. Instead of being driven, it has its armature (stator) windings connected to the existing three-phase power lines. DC excitation is still supplied to the field windings on the rotor.

Three-phase currents in the stator windings produce a rotating magnetic field which effectively duplicates that of the power station alternators. If the synchronous motor is brought up to a speed (by a small starter motor) where the field produced by its own DC field is rotating in step with that produced by the stator windings, it will "lock in" and continue to rotate at that speed. It is capable of considerable torque at this constant speed but, if more than its "critical torque" is demanded by the applied load, it will "drop out" and come to a standstill.

Thus the main features of the synchronous motor are that it is physically identical to the alternator, requires the same DC field excitation, is NOT SELF STARTING, and develops all its torque at the constant "synchronous speed."

Incidentally, a rotating magnetic field (the heart of most AC machines) may be generated or utilised in machines using other than the three phases we have been considering. Instead of three phases separated by 120 degrees, there may be four phases 90 degrees apart, six phases

60 degrees apart, and so on. All will prove satisfactory, and are in fact used on occasions but, in general, three-phase machinery and transmission is used because of its economy.

However, a rotating magnetic field cannot be directly produced from a single phase (two wire) supply. If motors, etc., are required to operate from such a supply (i.e., motors to run from the usual 240 volts line), special phase-shifting arrangements must be made to create the necessary phase difference and field rotation.

Hence the common "capacitor start," "capacitor run," "split phase," "shaded pole" and "repulsion-induction" motors. All these types use one method or another to either produce a phase shift in the stator current or to produce a magnetic phase shift in the motor structure.

The capacitor start motor uses a starting winding connected to the supply via a capacitor to produce the required phase shift. On speeding up a centrifugal switch disconnects the starting winding, and the motor continues to run simply on the pulsating single-phase field. This cannot supply a steady torque, so some motors (the capacitor-run and split-phase types) leave the second winding and capacitor in circuit all the time, constituting the second "phase" necessary for a rotating field.

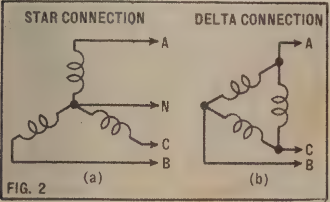


FIG. 2

Here we see the difference between star and delta connections for three-phase power systems. If the star system is connected to balanced loads, the neutral conductor carries no current and may be omitted.

Other motors employ mechanical rather than electrical means of producing the phase difference. The shaded-pole motor has a slot cut on one side of each pole on the stator, and a copper shorting ring placed around the small pole so formed. This produces a magnetic lag in this small pole, and thus the required phase difference. The repulsion motor uses brushes connected to the rotor itself, and short-circuited brush-to-brush to produce an induced rotor field lagging physically behind the stator field.

The final type of alternating current motor with which we will deal is the induction motor, which is perhaps the type most familiar to the majority of readers. This type of motor is similar to the synchronous motor in that it has a stator system producing a rotating magnetic field from the supply system, but differs in that it has a different type of rotor.

Instead of having a rotor winding supplied with direct current for excitation, the induction motor has a rotor winding which is short-circuited. The rotating field produced by the stator (armature) currents induces voltages in the short-circuited rotor, which acts as the shorted secondary of a transformer.

The induced rotor voltages produce rotor currents which lag in phase due to the rotor impedance A rotor field is produced due to the rotor currents which

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GE 2E/IIIA	3 channel	1xE88CC 1xE180F	40 db	6 db	1.2V	72/300Ω
GE 1B/III	channel 5-11	1xE88CC	17 db	7 db	0.7V	72/300Ω
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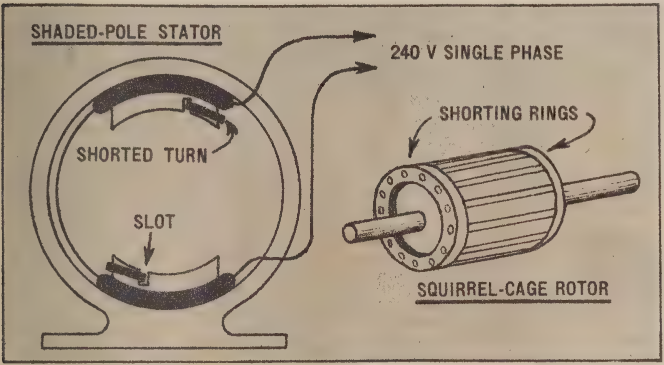
lags in phase the rotating field of the stator, and thus rotates around the machine "tagging behind" the stator field.

Reaction between the two fields produces torque on the rotor and the rotor turns, gathering speed and accelerating towards the "synchronous speed" represented by the speed of the stator field. Since the torque is roughly proportional to the difference in rotational speed between the stator and rotor fields, the speed will never reach synchronous speed, but will level off according to the load applied.

If friction and similar losses represent the only loading, the motor will run near the synchronous speed, with a small field lag or "slip." With higher loading, however, the motor has to reduce speed to supply the necessary slip and consequent torque. Thus speed reduces under loading, similarly to the case of the usual DC motor.



Shown here are the shaded-pole stator and the conventional squirrel-cage rotor. As explained in the text, the shaded-pole stator is a means of obtaining a pseudo-rotating field from a single-phase alternating current supply. The squirrel-cage rotor often appears in conjunction with such a stator in the usual gramophone motor, the composite being called a "shaded-pole squirrel-cage induction motor."

The actual torque-speed characteristic may be varied, by controlling the rotor impedance. High resistance-to-inductance ratio on the rotor causes less field lag and requires the motor to slow down further in order to supply a given torque. This produces a characteristic having good torque at low speeds and consequently a high starting torque. Similarly poor resistance-to-inductance ratio gives maximum torque at higher speeds and is used where high running torque is required but the starting load is small.

Some motors, notably larger types, allow the characteristic to be varied by bringing the rotor connection out via sliprings. For starting, resistances are connected to the rotor to increase its resistance-inductance ratio and produce good starting torque. When the motor speeds up, these resistances are gradually reduced and are shorted out if torque is required at higher speeds.

Such a motor is called a "wound rotor" induction motor, and does not differ markedly in construction from a synchronous motor or alternator. However, many small induction motors are not required to vary in load-speed characteristic. Thus, since the rotor windings would only be short-circuited, anyway, it proves economical to use what is called "squirrel-cage" construction.

In its simplest form, the squirrel-cage rotor may be a hollow cylinder of conducting material (copper, etc.) mounted on the shaft. Currents induced in the surface of the cylinder produce the reaction field and thus the cylinder experiences a torque.

In actual fact, this simple setup forms the basis of many speedometers and engine tachometers. The usual speedometer has a flexible cable geared to the motor and turning a permanent magnet within the instrument. The rotating magnetic field thus formed produces a torque in a copper cylinder or "drag-cup," which tries to turn against a spiral spring. An indicating pointer and dial show the equilibrium position reached, proportional to the drag-cup torque and the engine or shaft speed.

Other instruments, notably aircraft engine tachometers, etc., do not use a flexible drive system but employ a two- or three-phase alternator at the engine to generate alternating voltages. A two- or three-phase stator system in the instrument then produces a rotating magnetic field from the generated currents, and the field acts on the drag cup as before.

Most squirrel-cage motors do not have this type of rotor, but have a rotor whose construction closely resembles the ribbed exercise drum attached to the cages of rabbits, white mice, guinea pigs, etc. A good example is the usual record player turntable motor, which has such a rotor as well as a shaded-pole stator assembly.

Examination of such a rotor will reveal that the rotor has the usual longitudinal slots cut in the iron laminations, in which single copper or aluminium conductors are fixed. However, heavy shorting rings at each end of the rotor short all the conductors together. If the iron were eaten away with acid, the rotor would appear exactly as its namesake used to provide energetic animals with recreation.

The shorting rings-and-conductor assembly constitutes a shorted rotor winding as before, and the reaction field produces rotor torque. This type of motor obviously does not lend itself to rotor resistance control of characteristics, but the characteristic can be determined in manufacture to a certain extent by the number of conductor rods used, the size of shorting rings, and the metal used.

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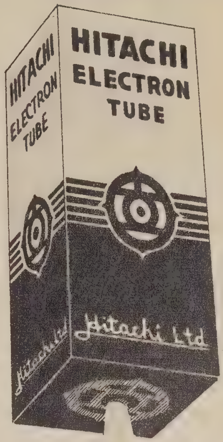

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In this, the final article on microwave techniques, we describe the construction of a suitable power supply and control unit for use with the RT 181/APG-30 radar unit, suitably modified for amateur band operation. Methods of frequency measurements are also discussed so that a fairly close check may be made on the operating frequency of the 2K25 klystron oscillator.

by Alan Nutt

One method of feeding a parabolic reflector is illustrated at the left. Alternative methods are described in the text which may be more applicable, particularly if waveguide sections are in short supply.

PRIOR to this, however, there are some further points which should be mentioned regarding the operation of the radar unit itself in order that we may complete our discussion commenced last month on the function of the various components found in this type of equipment.

The TR switch consists of a resonant cavity, tunable over the range from 8450 to 9600 Mc approximately and filled with an inert gas. Energy is coupled into the cavity through a small iris or window and leaves the cavity through a similar window on the opposite side. The physical dimensions of the cavity are adjustable by means of a screw projecting from one end.

Across the centre of the cavity, projecting from either side, are two cones which have a small gap between their apexes.

When a high energy pulse from the magnetron reaches the cavity, the gas immediately ionises and effectively shorts out the cavity between the cones, thereby preventing any energy transfer through it. As the gas would normally take a definite length of time to ionise, during which period the mixer crystal might well be destroyed, complete deionisation is prevented by the application of a high voltage to a probe extending from the top cap of the tube through the apex of one of the cones.

A small supply of ionised particle is always present, therefore, across the apexes of the cones, not sufficient to cause a marked degree of attenuation to the received signal but sufficient to cause almost instant ionisation on the arrival of the transmitted pulse.

In order to prevent received or reflected energy passing back into the magnetron where it would be wasted, an ATR switch is employed which, during the non-operative period of the magnetron, open circuits the wave guide leading to the magnetron. The open circuit is effected by cutting a broad slot in one wall of the waveguide, thereby interrupting the current flow in that wall.

The ATR switch is located across this gap and is simply a gas filled enclosure which quickly ionises on the application of the pulse from the magnetron, bridging the gap in the wave guide wall and permitting energy from the magnetron to pass to the antenna.

The automatic frequency control (A.F.C.) circuitry is fairly straightforward in its operation. The method used is by comparison of the magnetron frequency with that of the local oscillator, effected by mixing a much attenuated sample of the magnetron signal with the local oscillator signal in the second crystal and applying the resultant difference to an IF amplifier and discriminator circuit.

Providing the frequency relationship is such as always to produce a 30 Mc IF, the discriminator will develop not output control voltage. If, on the other hand, the frequency of the klystron shifts, due to a voltage change or for some other reason, a control voltage will appear at the output of the discriminator, the polarity of which will depend on whether the klystron went high or low in frequency.

PART THREE

This resultant control voltage is applied via a 6AK5 DC amplifier to two miniature thyratrons which are used to control the repeller voltage of the klystron and so bring it back into step.

The complete RF front end, including the magnetron, local oscillator, mixer and AFC crystals, TR and ATR switches, is known as a duplexer and it is possible to remove this entire section from the case, by removing the mounting screws from both ends of the wave guide.

The modifications necessary to place the equipment on the air require first that an audio amplifier and power output stage be added to the system. A discriminator circuit is already available in the A.F.C. strip, and so it is to this chassis that the audio stages may logically be added.

Commence by removing the components associated with valves V403, V404 and V405. The socket of V405 should also be removed, likewise the large 2 x .25 mfd capacitor. This will leave sufficient room for the inclusion of a miniature speaker transformer. Alternatively, of course, the transformer may be mounted separately on the loudspeaker.

The sockets of V403 and V404 should now be rewired to take a 6AU6 and a 6AM5, respectively. The heater wiring of both V404 and V405 was separated from the remainder of the heater circuitry and it will be necessary to wire the heater pins of V404 across to the socket of V403.

When the original components around the thyrotron sockets are removed, sufficient stand-off insulators will remain to permit anchoring the new components for the audio stages. In addition, several spare wires in the cable form to the output plug, P402, may now be used to bring in extra HT and to take shielded volume control leads as well as leads to the loudspeaker.

The output of the discriminator was directly coupled to the grid of V403, the DC amplifier. Now, however, AC coupling is required and a .01 mfd capacitor should be connected from pin 5 of the 6AL5 to pin 1 of the new 6AU6 stage. The 1K resistor from the test terminal may be dispensed with or returned to pin 5 of the 6AL5 as desired.

The DC return for the control grid of the first 6AK5 on the chassis, V401, was taken to the "D" pin of the plug, P402. This was for the purpose of metering the AFC mixer crystal current, the DC return of which comes through this lead. As this crystal is no longer used, pin "D" may be earthed either at the socket or in the chassis.

A point worth noting and one which often causes confusion, is that several of the paper capacitors used in this chassis are very similar in appearance to 1 watt resistors, even to the extent of being colour coded in the same way.

If in doubt, remember that there are no other resistors used in this chassis apart from easily recognised ½-watt types. Anything else which is not immediately recognisable may be fairly safely taken to be a capacitor.

The colour code, by the way, has the

same numerical values as the resistor code, the resultant figure being in picofarads.

We found that it worked quite well in practice to connect the output of the four-stage IF strip directly into the input of the AFC strip, although this latter unit was originally intended to be connected to its own mixer crystal. The impedance matching may not be optimum, but the result is the thing that matters in an arrangement of this nature. In effect, this now gives us a five-stage IF channel.

Some may like to make the final 6AK5 function as a limiter, although we found this to be unnecessary, AM noise pick-up being virtually nil on this band.

The original IF channel requires little modification apart from the earthing of the DC grid return for the second, third and fourth stages. This may again be done by earthing pin "D" at the power socket or directly in the chassis. The small mica capacitor across the output coupling link T304 should be removed and the coupling link itself increased to eight turns.

Provision for metering the mixer crystal current via the DC grid return lead of the first IF amplifier, V301, requires the meter to be permanently connected from pin A of plug P302 to ground, or, if meter switching is employed, a permanent shunt resistor wired in its place.

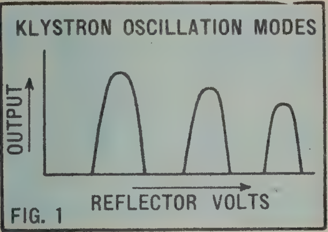


FIG. 1

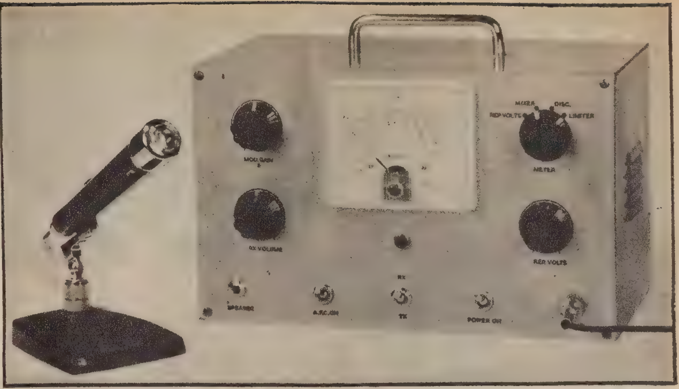
A reflex klystron will oscillate at several values of repeller voltage, but, as the voltage increases, less and less energy will be available for useful output as indicated in the above diagram.

Care must be taken that no more than 120-odd volts be applied to the 6AK5 stages, otherwise their dissipation ratings will be exceeded. The audio stages may have almost any voltage applied up to 300 volts.

The modifications required to place the duplexer section in operation depend largely on whether the completed unit is to function as a receiver, transmitter or transceiver.

Regardless of the application, the klystron power requirements will be the same. Between 200 and 300 volts at approximately 25mA will be required for the shell or beam electrode and a negative supply, variable up to 150 volts, is required for the repeller. Repeller current is in the order of a few microamps, so the construction of this supply should present no problem. Heater voltage is 6.3V at .44 amps.

Both the beam and repeller supply voltages must be well regulated and well filtered, the first requirement being necessary to prevent frequency shift, the second to prevent hum modulation. It is left to the individual experimenter to decide just how elaborate will be his own regulating and filtering system, the circuit diagram of the power supply shown in our prototype being considered as the absolute minimum.



The completed control unit, housed in a metal case, is an extremely compact assembly, permitting easy transportation for portable operation.

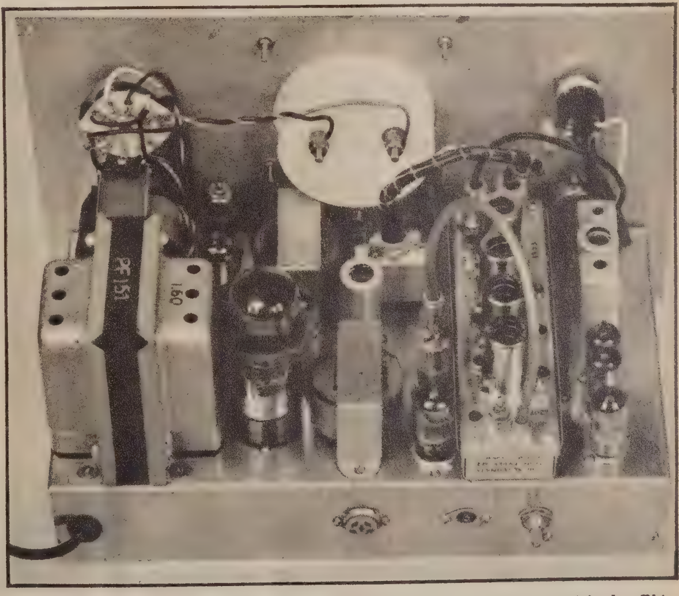
An important point to notice is that the klystron may be made to oscillate at a number of different values of repeller voltage. This phenomenon may be verified by swinging the repeller voltage control potentiometer through its entire range while monitoring the mixer crystal current.

The only difference between these states of oscillation is the number of electron bunches existing in the space between the cavity grid wires and the repeller electrode. Naturally, the higher the voltage on the repeller the faster will the bunches be returned to the grids. The actual number of bunches in this drift space is not important as far as oscillation is concerned; it is only important that the bunches arrive back at exactly the right time to promote oscillation.

The fewer the bunches arriving back to promote oscillation means a lower total energy level, and so it follows that as the repeller voltage increases the output from the klystron will be weaker each time it goes into oscillation. This effect is clearly illustrated in Fig. 1.

A measure of fine tuning control is available by means of this repeller voltage adjustment. It is possible to make the electron bunches arrive back at the grids somewhat out of phase, thereby forcing the cavity to oscillate at something other than its natural frequency. This "electronic tuning" range is considerably less than that effected by the mechanical struts, being something like 25Mcs before the output drops to half its optimum level, due to the lowered efficiency.

In order to set up for receiver opera-



A rear view of the control unit shows the layout which is not critical. This particular unit used a tone oscillator to modulate the klystron for alignment purposes but it is not included in the circuit diagram.

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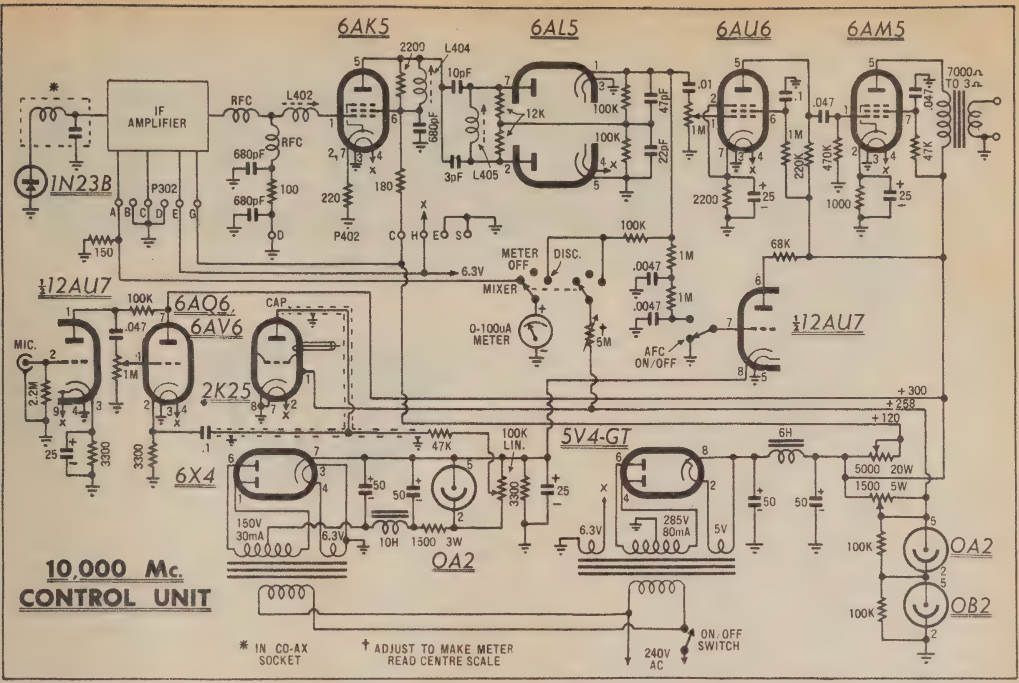


Although designed to use several of the valves in the RT-181 equipment, alternative types may quite easily be incorporated, none of the circuitry being critical in operation. If desired, a tone generator may be included, its output being fed into the top of the modulator gain control.

tion only, connect the power supply to the klystron, IF and audio chassis and the input co-ax of the IF channel to the output socket of the signal mixer crystal. The AFC crystal is not used at all and may be removed from its socket.

It is a wise precaution to leave the klystron in its original housing, firstly because it protects the operator from contact with the HT on the klystron shell and, secondly, it functions as a thermal shield around the oscillator, making it more temperature stable.

CURRENT MONITOR

A 1 mA meter should be connected as indicated earlier to monitor the mixer crystal current and the repeller voltage control rotated until a peak is obtained in the meter reading, indicating oscillation. It is immaterial which one of the oscillation modes is selected, the output in each case being more than adequate for receiver mixer requirements.

The oscillator injection may now be adjusted by means of the appropriate screw until the crystal current is 0.5 mA. The duplexer is now ready to function as a receiver, the only other adjustment being the TR switch cavity tuning which is peaked on an incoming signal.

For transmitter operation, it is necessary to mount the klystron in the correct place on a short length of straight waveguide section. The longest straight section available on the duplexer is the section between the front panel and the junction of the TR switch. The waveguide may be cut through just ahead of this point and the edges filed straight and all burrs removed.

A small aluminium or brass plug approx. ¼ in thick should be carefully filed until it is a good tight fit In the cut end of the guide. It is best if the plug dimensions are such that it requires placing in a vice to press it into position. A ⅛in hole should now be drilled in the centre of one of the broad faces of the waveguide, 7mm from the inside face of the end plug. This is to take the antenna probe of the klystron which may now be attached to the waveguide by a suitable clamp.

The klystron may be placed in operation as before, although, this time, it will be necessary to temporarily place a crystal across the end of the waveguide and connect it to a meter in order to monitor the output signal level. Frequency modulation of the klystron is accomplished by applying the modulating signal from a cathode follower to the repeller. Very little audio gain is required to deviate the required amount necessary for good reception, the exact setting of the audio gain control being best checked by experiment with the receiver.

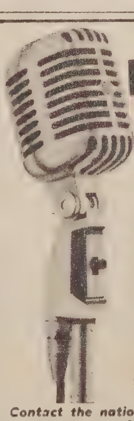
The AFC unit may be switched into the receiver circuit after the initial tuning of transmitter and receiver has been accomplished. The control voltage developed at the discriminator is applied to a DC amplifier which varies the voltage of the repeller with respect to ground and will keep the local oscillator in correct relationship to the incoming signal.

The 'lock-in' range of the AFC system is plus or minus 1 Mc, although, by judicious wiggling of the slugs in both the IF strip and discriminator, it is possible to increase this to something in the order of plus or minus 2.5 Mcs.

Obviously, if the frequency drift of either transmitter or receiver klystron takes the signal beyond the peaks of the discriminator "S" curve, the AFC voltage will be unable to correct the error and it will be necessary to retune manually.

The arrangements so far described require the use of two klystrons at each station if two-way contact is to be made. An alternative solution is to use one klystron only, functioning both as transmitter and receiver oscillator, thereby permitting duplex operation. In this case, only one AFC unit need be employed between the two stations.

Should this method be the one chosen, the klystron mounting should be re-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moved from its original position and remounted in the waveguide beyond the ATR switch, which should be removed. Cut the waveguide 1in beyond the ATR switch mounting and plug the end as detailed, likewise mounting the klystron the same distance from the sealed end, as before.

The only remaining task is to construct a shorting plug to fit down into the section of waveguide previously occupied by the 6038 ATR tube. (Fig. 2). This plug should be adjustable so that it may be placed a half-wave from the bottom end, in which position it effectively bridges the open circuit in the waveguide, the section functioning as a shorted half-wave stub. The exact position may be found by monitoring the crystal current for a peak reading while adjusting the position of the plate.

With the klystron mounted in this position, energy will be fed down the waveguide to the antenna, but sufficient signal will pass through the TR cavity to the mixer crystal. Providing the TR cavity is tuned to the frequency of the transmitting station, the attenuation of the signal from the oscillator will reduce the level to that required for satisfactory mixer operation.

KLYSTRON TUNING

The klystrons at both stations are tuned so that they differ in frequency by 30Mcs, the reason being that when their outputs are mixed at either station the resultant frequency in both cases will be the required IF of 30 Mcs.

Antenna arrangements will be the same for both transmitting and receiving and some relevant details are given for the benefit of those who may like to construct a high gain system.

Coupling energy into a parabola requires the use of a crook-shaped section of waveguide, assuming the equipment is mounted at the rear of the parabola, as is normally the case. The waveguide projects through the centre of the dish ana is folded back on itself so that the open or flared end is located at, or close to, the focal point and pointing into the centre of the dish.

Note that the waveguide feeding the antenna should be oriented in the same manner at transmitter and receiver. Failure to observe this will result in dissimilar polarisation and a reduction in overall performance.

One method we used is illustrated in the lead photo. No hook section was available, so several sections of curved waveguide were joined and taken underneath the parabola. The horn shown in the photograph, incidentally, is much larger than necessary when used in conjunction with a parabola and may even be dispensed with entirely.

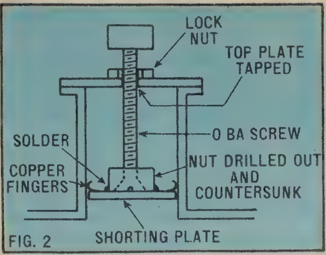

FIG. 2

Illustrating the construction of the adjustable shorting plate necessary to take the place of the ATR switch if the klystron is mounted for transceiver operation.

An alternative method, where waveguide is scarce, is to insert a short length of straight waveguide through the centre of the dish and just beyond the open end to place a half-wave rod. The length of waveguide should be such that the rod is just at, or slightly beyond, the focal point of the dish as determined by a field strength test using one of the 1N23B crystals and a meter.

REFLECTOR ADDED

A reflector element is added just beyond the antenna rod, its function being to cause the energy radiated by the antenna rod to be reflected into the parabola. All the relevant dimensions are given in Fig. 3.

A simpler method, and one we actually used for our very first test, consisted in mounting the entire duplexer unit in front of the parabola, rather than behind, and adjusting its position for maximum forward gain. The waveguide may be left unterminated or a horn added as desired. Having such a large mass of metal in the path of the reflected beam seemed to have no adverse effect on the received or transmitted signal.

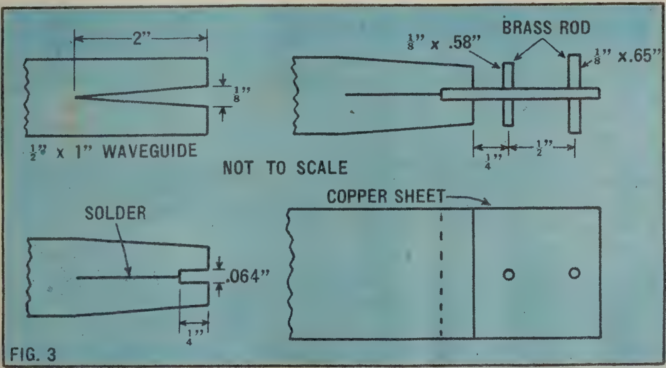

FIG. 3

All the necessary dimensions are given in the above illustration to permit the construction of an efficient antenna system which may be mounted at the focal point of a parabolic reflector. The antenna elements should be well soldered to the copper sheet through which they pass.

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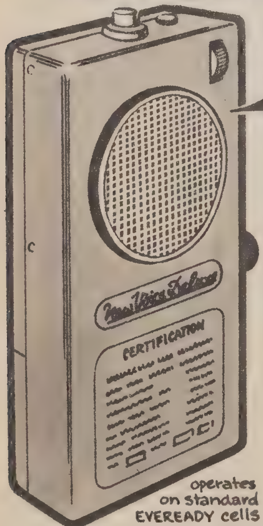

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Finally, the most important modification—changing the klystron tuning range so that it may be made to oscillate in the amateur band.

As mentioned previously, the upper limit of the 2K25, with the tuning struts completely straightened out, is something in the order of 9,900 Mcs. In order to raise the frequency sufficiently to place the socillator in the amateur band it is necessary to raise the opposite side of the cavity diaphragm as well.

The cavity support on this side is held between two nuts on a threaded post, the preset position being permanently fixed by spot welding. Carefully file away the weld until it is possible to shift the upper nut with a pair of pliers.

This nut should be unscrewed exactly one turn. The lower nut should then be very carefully tightened up against the upper one, thereby lifting the diaphragm. After resetting, make no further attempt to move the nuts as the diaphragm seal may be permanently damaged. It will still be possible, however, to tune by means of the adjusting screw on the opposite side in the same way as before.

OPERATING FREQUENCY

Measurements carried out after this adjustment placed the operating frequency at 10,220 Mcs, almost in the middle of the band. No appreciable decrease in oscillator activity was observed.

Fairly accurate frequency measurements may be carried out, if desired, by mounting a crystal and klystron in a short length of waveguide, the crystal current serving as an oscillation indicator.

On the opposite side of the klystron to the crystal, a narrow slot should be cut lengthways with hacksaw along the centre of one of the broad faces of the waveguide for a distance of three inches or so. The klystron should be adjusted to give a peak reading in the crystal current before measurements are attempted.

A ¼in wide strip of thin brass shim is now inserted through the slot in the waveguide and moved up and down its length. It will be noticed that at specific points along the slot, the crystal current will pass through a sharp null. Measuring the distance along the slot between two consecutive null points will provide the in-guide half-wavelength figure from which it is possible to calculate the true wavelength by the formula given above.

$$\lambda_G = \frac{\lambda}{\sqrt{1-\left(\frac{\lambda}{\lambda_C}\right)^2}}$$

and

$$\lambda = \sqrt{\frac{\lambda_G^2 \cdot \lambda_C^2}{\lambda_G^2 + \lambda_C^2}}$$

Where λg is the in-guide wavelength and λ is the free-space wavelength. λc equals 2z in a rectangular guide and 1.64a in a cylindrical guide where 'z' is the wider dimension of the rectangular guide and 'a' is the radius of the cylindrical guide, measured in centimetres.

As an example, the distance between crystal current nodes in a 0.9in x 0.4in waveguide will be approximately 1.92 cm, giving an in-guide wavelength of 3.84 cm and a free-space wavelength of 2.94 cm.

MEASUREMENT ERROR

It will be obvious that the accuracy of measurement along the slot will be the main factor in determining the amount of error in the calculated wavelength. Ideally, an attenuator section should be used to isolate the klystron from any pulling effects but we found that this simplified method yielded quite acceptable results.

As an example, we calculated the upper frequency limit of the 2K25 in its unmodified condition to be a little over 9,900 Mcs. Likewise, after modification, the calculated frequency was checked out at something a little above 10,200 Mcs. Later checks obtained from an accurate and reliable source placed the two frequencies at 9,930 Mcs and 10,220 Mcs, an error of approximately 0.2%.

With the setup described, power output will be in the vicinity of 25mW but even at such a low level good signals should be received over any line-of-sight distance. Working over a five-mile path, signals were a good S9 and the quality remarkably good, despite the somewhat high hum level.

We hope that the information given will assist not a few to make good use of equipment which previously may have been "junk" or only a source of spare parts. Obviously, we have been able to give only a very general picture but, who knows, sufficient interest may have been aroused such that in a short while, microwave band will be as populated as the present VHF bands.

The SHURE
SLENDYNE
Microphone
Model "525"
This microphone is suitable for indoor or outdoor applications. It can be mounted on a conventional floor or desk stand, held in the hand or with lavalier cord and belt clip. Price: £71·15 - plus tax.

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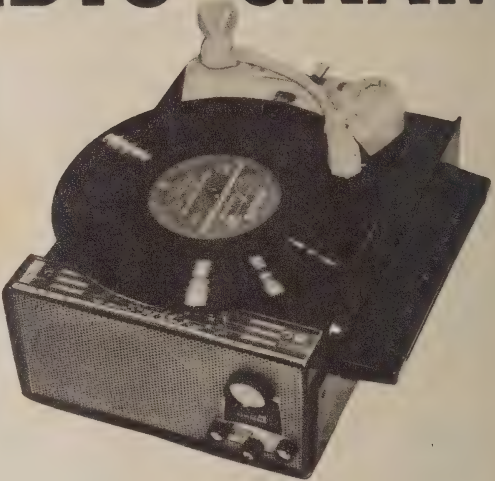

The Ferris Model 154 Portable Car Radiogram is designed to operate as a car radio and as a portable and home radiogram. The car radio is based on the highly popular Ferris M144 Portable Car Radio which has broken all production records. The record player is a Philips unit of proven quality. Combined, it is, in the opinion of our engineers, the finest piece of electrical engineering we have produced. Seven transistors are used. Price 73 Gns.

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"CAR" selects car aerial by switching into circuit a high gain aerial coil and, at the same time, effectively shorts out the Ferrite rod aerial so that random noise pulses, i.e., ignition interference, are not fed into the set when it is being used as a car radio.

"PORT" switches out aerial coil and brings Ferrite rod aerial into circuit.

"GRAM"—this position mutes the front end of set and connects audio section to pick-up.

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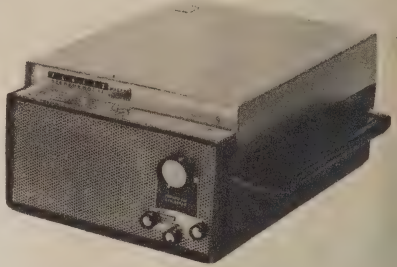
The Ferris Model 154S Stereo Unit is a four transistor amplifier which is designed to be used in conjunction with the Ferris M154 Portable Car Radiogram. Having no battery of its own, the M154S draws its current from the master unit. The gain control is quite independent of the master unit so that, apart from being used for stereo, it can be used as an extension unit in an adjoining room, etc.

Retail price 19 gns.

CABINET DESIGN AND CONSTRUCTION



The Ferris M154 has been designed to have more of an "instrument" appearance . . . it is quite a classic. All metal is used in the case for two good reasons: firstly to shield against car ignition noise and secondly to give longer life as a portable radiogram. This case will protect much more than a plastic one.

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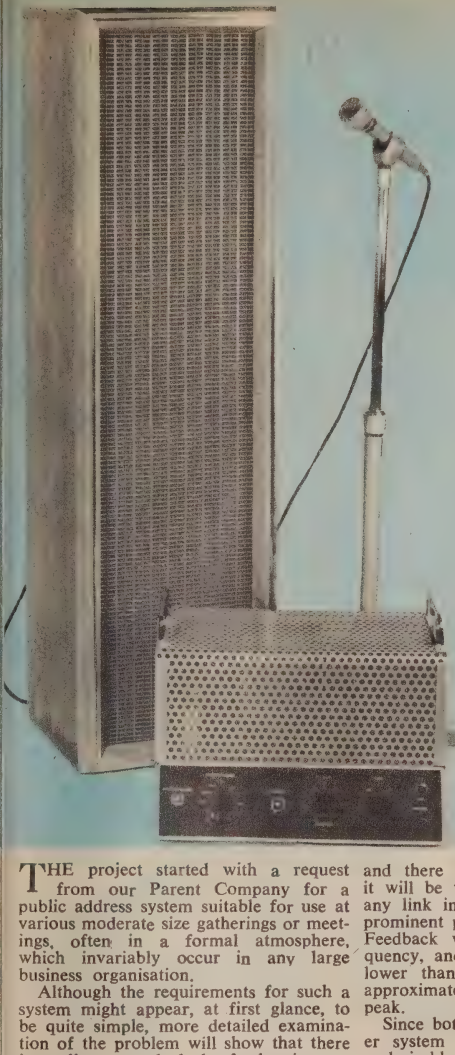
A HIGH QUALITY 35-WATT PUBLIC ADDRESS SYSTEM

Here is a story of a public address system which we recently had occasion to make up and install. The requirements were so typical and the final set-up worked so well that we felt it would be well worth while passing the details on to readers. Even if your requirements are not exactly the same, it provides a good basic plan from which to start.

By P. Watson and J. Davidson



The complete PA system. The column measures only 3ft high, not much higher, than the Zepher banquet style microphone stand alongside it. The amplifier is similarly compact, yet has ample power for any likely application. An additional mixer unit can be added if required.

THE project started with a request from our Parent Company for a public address system suitable for use at various moderate size gatherings or meetings, often in a formal atmosphere, which invariably occur in any large business organisation.

Although the requirements for such a system might appear, at first glance, to be quite simple, more detailed examination of the problem will show that there is really a good deal of planning required is the end result is to be completely satisfactory. It is not, for example, simply a matter of connecting up any old microphone, amplifier, and speaker, selected at random, and hoping for the best.

FEEDBACK PROBLEM

A major problem, with any PA system, is feedback, and this becomes doubly important where it is envisaged that the equipment may have to be set up and left to the mercy of relatively unskilled persons. The more prone the system is to feedback, the more likely are those concerned to get into strife, with general dissatisfaction all round.

Again, a system which is to be set up in all kinds of temporary circumstances, where acoustics may be anything but ideal, may often be battling to keep feedback within acceptable limits. Unless it is relatively free from this tendency in the first place it may be well nigh impossible to provide any worthwhile coverage.

While feedback is a basic problem, and there is no complete cure for it, it will be very seriously aggravated by any link in the chain which exhibits a prominent peak in the audible spectrum. Feedback will occur first at this frequency, and at a gain setting which is lower than it would otherwise be by approximately the amplitude of the peak.

Since both the microphone and speaker system can easily suffer from this undesirable characteristic, they need to be selected with a good deal of care.

Again, the question of appearance must be considered. Whether for use in a church, board room, or banquet hall, the visible portions of the system must be made as unobtrusive as possible. Horn speakers may be a logical choice out of doors or in a factory, but they are hardly objects of beauty.

Similarly, the microphone, being probably the most obvious part of the system, must be selected with some thought as to its appearance as well as performance.

This, then, is something of the background against which we set out to make up our complete PA system.

Although, initially, only a bare minimum of requirements had been called for, we felt it would be wise to have something in reserve, both as regards available power and, if necessary, the variety of input circuits, mixing facilities. etc.

After giving the matter some thought, we finally selected the 35 Watt PA Amplifier described in the March and April 1958 issues. This offers ample power output, yet is of compact construction. It is fitted with a simple microphone/pickup mixing system capable of coping with most ordinary requirements, or may be coupled to a more elaborate plug-in mixing unit on the rare occasions when this may be needed.

Being designed as a PA amplifier, it is equipped with a "500 ohm line" output transformer, capable of accommodating from one to 10 loudspeakers, using 500 ohm inputs, over any likely length of line. This means that it can cope with virtually any likely speaker requirement.

The gain has been kept high in both the pickup and microphone channels, again making it ideal for use with whatever units happen to be selected for other reasons. Even so, the circuit provides for approximately 12 db of feedback, which is adequate for an application of this kind.

EARLIER ARTICLE

This is necessarily a brief summary of the amplifier's characteristics. Those who require greater detail should refer to the original article. A few back copies of both the March and April 1958 issues are available as we go to press.

The next decision concerned the microphone. As already stated, a smooth response is essential here if feedback is to be minimised, and peaky microphones probably cause more feedback problems than any other single factor.

The unit we finally chose was a dynamic type, the AKG D19B. This is a microphone which has proved extremely popular with radio and television stations even though, by such standards, it is a relatively inexpensive unit. It has a cardioid directional pattern and a smooth response from 40 to 16,000 cps. This range is perfectly adequate for good quality musical reproduction, while the absence of peaks and the directional characteristics are most valuable in controlling feedback.

The unit may not appear cheap when compared with what might be termed the "popular" types, but its price would

Breathtaking perfection in record reproduction with the sensational new

AMERICAN ADC-1 STEREO CARTRIDGE

and a perfect mate, the

J. H. TRANSCRIPTION TONE ARM

Mr X (a prospective customer): Don't tell me, there is now another one of these cartridges on the market, claimed to be the best of them all.
Mr Z (an audio authority): The ADC-1 is definitely not another "best" pickup cartridge, but, undeniably, the finest in the world today, simply because it has an unusually high compliance of 20 x 10-6 cm/dyne—this is the guaranteed minimum—and a phenomenally low stylus tip mass of only 0.5 milligrams. This has not been even approximately achieved by any other mono or stereo p.u. make and, without question, represents a design breakthrough.

Mr X: All sorts of claims are made by manufacturers of p.u. cartridges A, B, C and D and every one of these is supposed to be the very best, according to the advertisements.

Mr Z: No pickup manufacturer has yet claimed such specifications.
Mr X: It is easy to make claims, however, how can you prove that they are true?

Mr Z: Very simply. The ADC-1 will cleanly reproduce the most complex orchestral or choral passages in stereo with a tracking force of only .75 grams, provided, of course, a tone arm of the very highest quality is used. Other heads require 2-4 gms. for clean sound and the grooves have "to push" harder, because the mass is larger and compliance smaller.

Mr X: Who on earth wants to play records at .75 gms. anyhow. 2-4 gms. are good enough for me.

Mr Z: At a pressure of 1 gram or under, record and stylus wear are reduced to the vanishing point, insuring a continued high level of sound reproduction. This, certainly, does not apply at pressures of 2-4 gms., particularly so, when a 0.5 to 0.7 mil stylus is used.
Mr X: How does the listening quality of the ADC-1 compare with its closest competitors?

Mr Z: It is incomparably superior and, for sheer naturalness and undistorted ease, it has no peer. Obviously so, because, as the compliance is so high, the grooves are under no strain, and (I quote from the performance report in the American "Audio" magazine): "shadings and nuances are revealed one had not known were in the recording." With a stylus mass of 0.5 milligrams and a tip radius of 0.6 mil, the upper resonant frequency of an average vinyl record occurs well above 30 Kc/s, which eliminates the need for mechanical damping. This results in an immeasurably small intermodulation distortion and (to quote again from "Audio" performance report): "the smallest amount of coloration of any of the cartridges we compared it with."

We, the manufacturers of the now so very well introduced J.H. Transcription Tone Arm, did originally import one sample ADC-1 cartridge just to prove to ourselves that our arm would track a stereo disc under 1 gram. As the arm can be very accurately dynamically balanced and has virtually unmeasurably small bearing friction, we were convinced that it would probably track under 1 gram, however, there was no head available anywhere in the world to trace properly at that low a force. And so, after having read the wonderful and enthusiastic reviews in "Audio" (May, '61), and "High Fidelity" (June, '61), we obtained one ADC-1 cartridge. As expected, our arm performed brilliantly and tracked effortlessly with superb head at .75 grams and there was no groove jumping, even if one walked very heavily on the floor. (Our turntable was not spring-mounted.)

The performance of the ADC-1, however, was beyond our wildest expectations (we A-B'd it against the best cartridges available today) and so we decided to secure sole agency rights for Australia. We herewith proudly present this superlative reproducer to the serious music-lover and discriminating listener and for the most critical broadcast, recording and laboratory use.

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seem to be fully justified for an application of this kind. We felt it was a sound investment which would amply repay its first cost.

Output impedance of the unit is 200 ohms, which means that a transformer must be provided to step this up to a value more suitable for feeding the grid circuit of a valve. While this calls for some modification of the amplifier, the use of a low impedance microphone line has many advantages. Both stray pickup and cable losses are reduced to a minimum, meaning that the cable may be almost any length required.

EXTRA PRECAUTION

(In fact, at this impedance, it is often feasible to use long microphone cables without any shielding at all. However, this can be risky, leaving the system open to hum or RF pick-up in extreme circumstances. RF may come from nearby broadcast transmitters, or mobile utility services. Inadvertent reproduction of the latter, in particular, can be extremely disconcerting.)

As supplied, the microphone is fitted with a twin conductor, shielded cable, as commonly used in professional studios. In this arrangement, the shield forms no part of the signal circuit, being merely connected to the microphone case at one end and the amplifier chassis at the other. The signal is carried on the two conductors, one of which is made earthy at one point only, the common chassis connection for the pre-amplifier stage.

In the event that the original cable is not long enough, any additional or replacement cable should be of the same type, such as the Zephyr type 14. Although it is possible to open the microphone case and fit a new length of cable, this is quite an intricate job, and any damage which results might prejudice the maker's guarantee.

For this reason, we strongly recommend that any extension of the cable be made by removing the cable connector, and carefully splicing the extra length on to the existing cable.

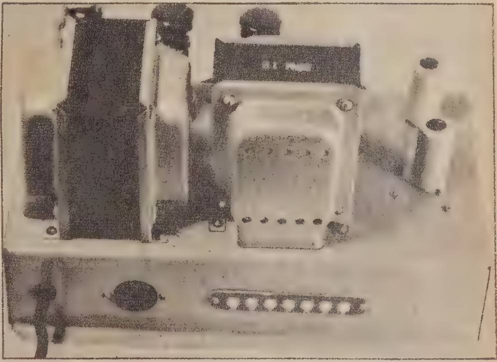
The microphone transformer is also an AKG unit, type U204. This has a matching ratio of 1 to 15, a response from 50 to 20,000 cps at the 2db points, is mu-metal shielded, and is intended for under-chassis, single hole mounting. It is quite small, measuring only ¾in diameter by ¾in long.

NO HUM PICKUP

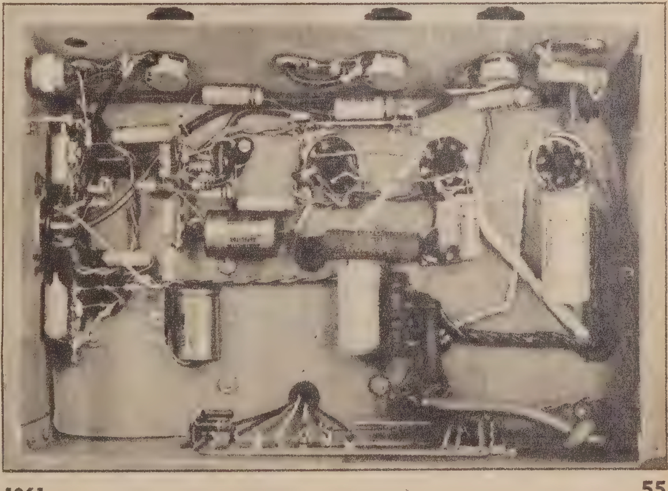
We mounted it against the end of the chassis, adjacent to the microphone input socket. The shielding appears to be perfectly adequate, no pickup from the power transformer being experienced, and no particular orientation found necessary.

Whereas the original amplifier was fitted with two microphone inlets, wired in parallel, we felt that this was no longer necessary. A single socket was therefore fitted, the position of which can be seen in the photograph. A new engraved panel helped to hide the old mounting holes. Note that the microphone socket must be insulated from the chassis, with the washers provided, in order to maintain the single point earthing system—the earth point being adjacent to the preamplifier valve socket.

Next we had to consider the speaker system, both as regards the speakers themselves and the method of housing them. Remembering our experience



These three pic-show the front, rear, and underside views of the 35 Watt PA amplifier. Modifications to the original chassis (discussed in the text) include the fitting of a microphone transformer adjacent to the microphone input socket (top left corner in the underchassis view), and the fitting of a single microphone socket in place of the original parallel connection. The octal socket and the terminal strip on the rear of the chassis both provide output circuits at line impedance to suit a wide variety of speaker combinations. Permanent speaker systems may be wired to the appropriate pins of an octal plug, temporary installations direct to the most suitable terminals.



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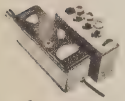
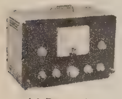


G.D - 1B



H.D - 1

0-12u. High Performance 5in Oscilloscope Kit. Gives laboratory performance at less than utility 'scope price. Vertical frequency response 3c/s—5Mc/s. Exceptional sweep circuit range of 10c/s—500 Kc/s in 5 steps. **£64/8/-.**

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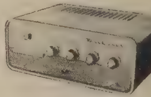
A.G - 9A

A.R - 3



S - 88

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FREE CATALOGUE describes the big range of Heathkits for testing, amateur radio, stereo, auto and marine available on request.

with the column described in the July issue of this year, we were immediately inclined to use this same system again.

A major advantage of the column is the relatively narrow angle of radiation in the vertical plane. This means that, by mounting it at an optimum height, most of the signal can be made to pass over the heads of those seated close to the speaker, becoming progressively more effective towards the rear of the auditorium. In this way, those at the rear may be given adequate level, without the risk that those in the front will have to endure an uncomfortably high level. In short, we get a substantially even level of sound along the entire length of the hall.

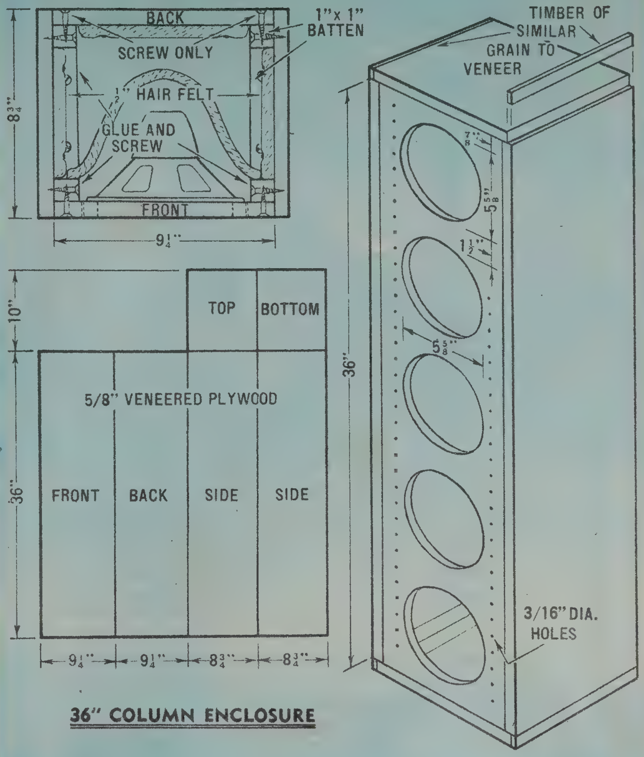
SIMILAR PROPERTIES

It is true that somewhat similar characteristics exist in the conventional horn type PA speakers, and can be used in the same way. However, as already mentioned, these are hardly objects of beauty nor can they boast any degree of fidelity.

The only problem was the need, if possible, to produce a column rather smaller than our previous model, but to do this without seriously sacrificing performance. On the other hand, we felt that such a column, if practical, would have a considerable appeal to readers, and so was worth a try.

We were encouraged in this idea by the characteristics of a speaker in the Magnavox range which seemed to suit our requirements particularly well. This is the 6WR, a six inch, twin cone, wide range model, with a bass resonance of only 40 cps.

This latter point is most important. The effect of mounting a speaker in a closed box is to raise the cone resonance quite markedly, meaning that either the box must be inconveniently large or we must tolerate a peak relatively high in the range. If we can start with a naturally low resonance cone, then a small box may not raise it to an unduly high figure.



36" COLUMN ENCLOSURE

This diagram gives all the measurements required to construct our new column. It can be cut from a 3ft x 4ft sheet of ⅝ thick plywood, preferably with a veneer finish. Note vent holes along each side of the front panel.

The basic behaviour of this column turned out to be no different, in principle, from that of the previous model. With five 6in speakers mounted in it, the bass resonance rose from the nominal 40 cps to around 125 cps. While high, perhaps, by "hi-fi" standards, it was still very gratifying considering the compact nature of the column.

However, as before, the amplitude of this peak was also quite high, and this called for the same technique as we used before; the provision of a large number of small holes in front of the panel to act as a distributed vent. The advantages of this arrangement over the conventional vent are twofold; it gives each speaker an equal "share" in the vent system, and the small holes act as an acoustic resistance to provide a useful amount of damping to the "Q" of the enclosure.

The final result is a quite modest peak at around 125 cps, with a gentle rise to a similar peak at around 30 cps. Within the limitations of its size this behaviour is similar to that of a normal vented enclosure; the production of two fairly well separated moderate peaks in place of a single large one, with some extension downwards in frequency.

This result may not satisfy the out-and-out "hi-fi" enthusiast but, as we have emphasised on previous occasions, this type of column speaker is not intended for such application. It is intended, primarily, for PA systems, particularly where it is desired to provide something better than average in both performance and appearance.

Matching the column speakers to the amplifier is achieved by means of "line to voice coil" transformer mounted inside the column. It has a 500 ohm primary and a tapped secondary providing 3.75 and 15 ohms. The voice coils are connected in parallel and fed from the 3.75 ohm tap. Although not strictly accurate, the degree of mismatch is negligible.

Alternatively, this transformer may be used as an auto transformer if it is desired to feed the unit from an existing 15 ohm system.

In conecting the speakers together, it is important to maintain correct phasing. Normally, assuming speakers of the same make, type, and — ideally — batch, the voice coil connections should have consistent polarity, and it would be in order to wire them accordingly. However, it is

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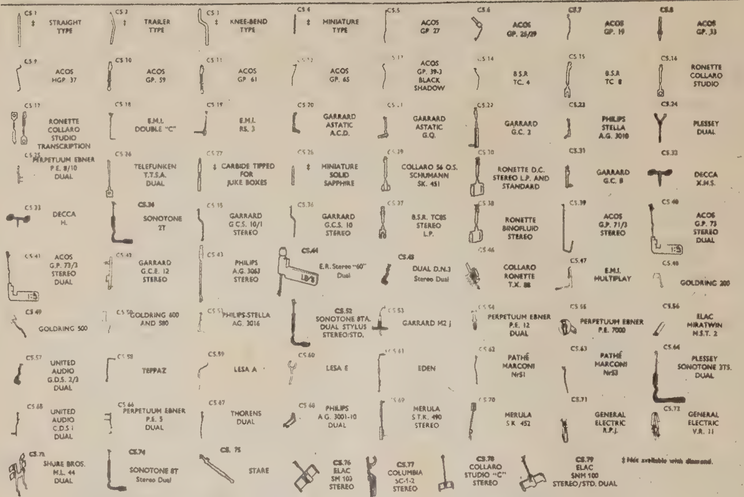
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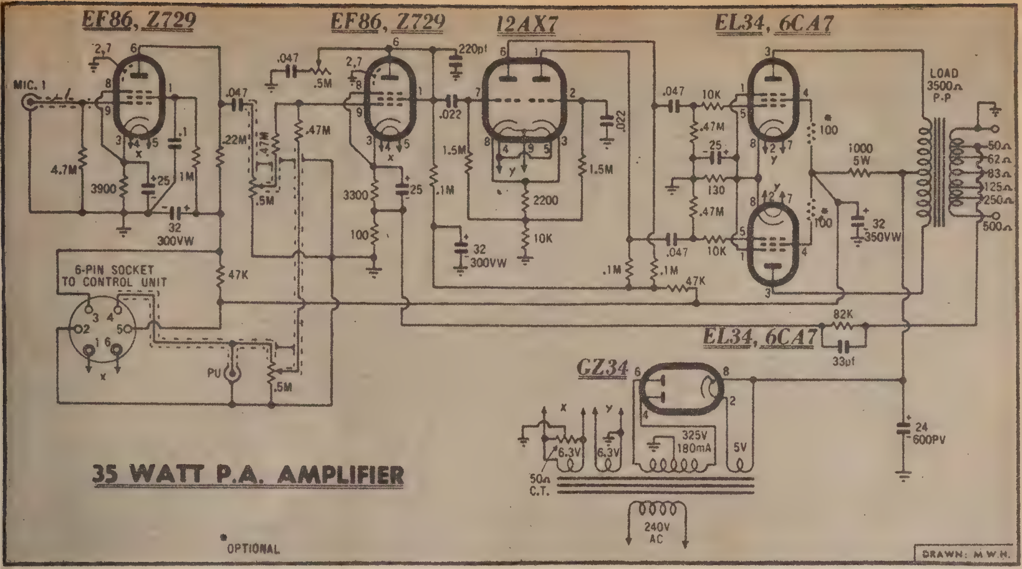

a simple matter to connect a torch cell across the assembly and note that all cones move in the same direction.

To build the column, we purchased a sheet of 5/8in maple veneer plywood. Although a full 6ft by 3ft sheet, it is expected that some of the more obliging timber firms will supply a sheet 3ft by 4ft which allows for a minimum of offcut.

The markings and cutting out of the sheet is straightforward and the drawings on page 57 have been laid out to reveal the greatest amount of detail. Having cut the sheet, the edges should be planed straight and square, remembering to plane from both ends to prevent chipping of the corners.

Begin to mark out the front panel by running a centre line from top to bottom, along which the positions of the five 6in speakers can be marked as follows. Allowing 7/8in at the top, measure off 5 5/8in per speaker cutout, each spaced 1½in appart, so that the lower cutout will finish 1in from the bottom.

CUTTING THE HOLES

The cutouts will have a radius of 2 13/16in and the waste material can be removed by drilling a series of 1/8in holes along the waste side of this line and cutting out with a compass or keyhole saw. Firstly a wood rasp and then sandpaper will soon clean up any rough and untidy edges.

As with our previous enclosure, we used 1in by 1in dressed batten in the four vertical corners and also along the sides at both top and bottom. This batten will be screwed and glued in all corners except to the back panel, which is screwed only.

The plan drawing shows the position of the screw clearance holes and when these have been drilled, the glueing and screwing can begin. Casein blue is the logical choice for this job. It has the advantage of cold mixing, a long setting time which permits unhurried assembly, and excellent strength when dry. Care should be taken that the glue does not stain the veneer surface.

The circuit features high sensitivity output pentodes, a "long tailed pair" phase inverter, and low noise valves in the first two stages. It has ample gain for most microphones or crystal pickups, with a simple mixing system between the two channels.

With one side placed on a flat surface, two main vertical battens are glued and screwed in position, allowing a margin along both edges equal to the thickness of the plywood. Two short strips of batten then join the end of the vertical strips, flush with the ends of the side sheets. The same routine is followed for the other side.

The next step will be to screw the back to both side sheets, then glue and screw the front sheet in position. Providing the original trueing-up work has been done correctly, the cabinet should be reasonably square and can be allowed to dry.

The next stage will be to square up both ends in preparation for the top and bottom pieces to be glued and screwed in position. Special care should be taken, when planing the ends of the column, that the veneer does not split.

Having been planed straight and square, the top and bottom pieces are positioned flush with the front and rear of the cabinet but equally spaced from both sides by approximately ¼ inch, as shown in the isometric sketch. While gluing these pieces, keep in mind that the back must be removable and is at present in position solely to provide a more rigid assembly, and must not be glued. We were able to screw the top and bottom in position by holding the screwdriver through the speaker cutouts.

To remove all traces of end grain on the four corners, strips of maple or other timber of similar characteristics to the veneer. are planed to fit these corners. In gluing these, application is made to both strip and cabinet and the two surfaces are rubbed together to remove any

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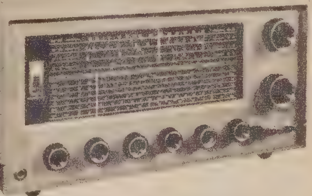

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air bubbles. A couple of pins will hold each strip in place while the whole cabinet is left overnight to dry and set.

The vent is a series of holes drilled along the front panel. This is done by drawing a pencil line down both sides of this panel, just clear of the speaker frames, and drilling two lines of 3/16-inch holes at 1 inch intervals.

The front and rear edges of the side sheets can be planed level with the front and rear faces. In planing the corner strips, the plane blade should be finely set and prevented from coming in contact with the veneered finish. Otherwise, an ugly cut may permanently mar the appearance of the cabinet.

CABINET FINISH

Finally the whole cabinet can be sanded, firstly with a medium grade and then with finer grades of sandpaper. We planned to cover the front panel with "Tygan" fabric and, to prevent the speaker cutouts from being visible when this is in position, the front panel was given a coat of flat black paint. A piece of this fabric 36in by 10in is required and this is either stapled or glued using the recommended PVA glue.

The moulding chosen for the edges is supplied with a gold bead which is fitted to a centre groove. This moulding was first mitred then attached using 1½in panel pins nailed into this groove. The heads were driven home using a piece of sheet metal as a punch. The gold bead can be mitred using either a fine file or a razor blade but the fitting should be left until the rest of the work is complete. (The razor blade should be one of the single edge variety with a rigid back. Its use in this role may seem drastic, but it provides a convenient way of performing an otherwise awkward task.)

To give the column a professional finish we decided to use one of the liquid plastics (Estapol, Bourne Plastic, etc.) popular for wooden floors and furniture. We purchased the smallest quantity of "Estapol" available, which consists of two solutions, A and B, each in ¼ pint tins. A tin of "Estapol" Reducer, a quantity of methylated spirit, a clean brush, and a measuring glass are also required.

Before doing any finishing work on the column, it is a good idea to mask any sections which need to be protected, such as the speaker fabric. Proper masking tape, or most other "sticky" tapes may be used for this job.

WOOD FILLER

Following the directions of the liquid plastic manufacturer, the timber was filled with "Wattyl" wood filler and after being wiped off, was allowed to dry over a weekend. At least two days should be allowed after filling otherwise faulty adhesion will almost certainly result.

(In some cases, excellent results can be obtained by applying the plastic directly to the unfilled wood, the finished colour depending on the extent to which the plastic "wets" the particular type of wood. Experiments may be conducted on waste pieces from the speaker cutouts.)

Having allowed adequate drying time and made sure that all excess filler has been removed, the plastic coating can be commenced. It is most important that the manufacturer's directions be carefully read and fully understood before attempting to mix the plastic. For Estapol, MEASURE and mix equal quantities of A and B solutions, sufficient only for the immediate requirements. Any excess will not keep more than a few hours, and is therefore wasted. Two ounces of both A and B solutions mixed together produced a little over enough for one coat of this enclosure.

The solution can be applied to the surface somewhat more generously than might be done with paint, providing that it does not run. Brush marks will not normally be visible after drying. Some 6 to 24 hours later, after a light sanding, a second coat can be applied. In preparation for the final coat, sand with No. 500 wet and dry.

The brush must be cleaned immediately after each coat and a brush washing solution is prepared by mixing one part of "Estapol" Reducer with three parts of methylated spirit. Firstly wash the brush in a small portion of this solution and brush dry on a wooden surface, repeating this procedure two or three times using fresh portions of solution each time.

When the final coat of plastic is completely dry the gold bead can be fitted into the centre groove of the front moulding and the adhesive tape removed from the edges of the speaker fabric.

HAIR FELT

All inside surfaces with the exception of the front panel are then covered with ¼in hair felt. A baffle curtain is also draped loosely around the rear of the speakers and tacked in position.

And what of the end result? How did the whole combination sound when finally set up to do the job for which it was built?

In a word: Excellent. In fact, it can fairly be described as one of our most successful projects. As we said earlier, performance is not to be judged on "hi-fi" standards, yet the combination a high quality microphone, wide range speakers free from serious peaks, and the column housing, resulted in clean smooth sound as is heard all too rarely from PA systems.

Precisely the same remark applies when the system is reproducing recorded music. This would indeed be an excellent system for use in churches or places of public entertainment.

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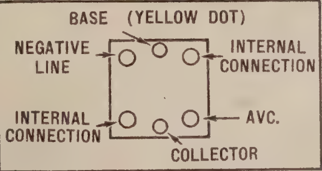

A FEW readers have experienced difficulty in identifying the base connections on commercially available IF transformers intended for use with this set.

The transformers used in the original set were supplied by Telecomponents Pty. Ltd., and the connections for these units are shown here to clarify the situation. They are the same for both the type 919 and 9181.

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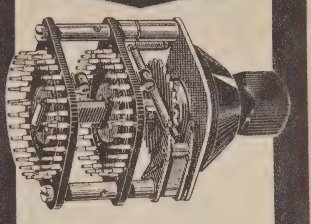

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40 Transistor 4
41. Transporta 6
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MIC 1
MIC 2
PU 1
PU 2

This view shows our new audio mixer unit complete in its case. Made from plywood and covered in wood-grain plastic laminate, the case blends well with almost any existing audio setup. Full details for the case are given in the text, for readers wishing to duplicate the original.

VERSATILE 4-CHANNEL AUDIO MIXING UNIT

Here is a four channel audio mixer unit which enables owners of amplifiers, movie projectors and tape recorders having only one input to blend the signals from four sources. Having two in-built microphone pre-amplifiers and completey independent volume controls for each input, it is powered by an in-built silicon diode power supply. With a response flat over the audio spectrum, low hum and noise, and negligible distortion, it will perform extremely well in most audio applications.

By Jamieson Rowe

MANY tape recorders, projector amplifiers and public address units of the more conservative variety have only one input facility, which is usually intended for medium to low level inputs in the range 10-100 millivolts. If it is desired to blend and fade a number of audio sources, such as is required for the compilation of tape commentaries, film sound tracks, etc., the single input becomes embarrassing.

Makeshift methods are sometimes employed in such instances to perform signal mixing, such as placing the single microphone near the speaker of a record player when music is desired rather than speech. However, such methods are usually very unsatisfactory and result in inferior recording, due to operating difficulties, distortion in the speaker-microphone setup, and acoustical reverberation effects.

Alternatively, the amplifier of the recorder or projector may be modified to provide a second input connection and volume control, but this method also has its difficulties. Multiple functioning of many sections of the usual economical design renders the addition of a second input connection difficult, apart from the worry of somehow fitting another control and input connector to a crowded panel.

Such modifications, even if successful technically, often tend to reduce the resale value of the unit.

The most satisfactory solution to the problem is by the use of an external mixing unit. This accepts the signals from the various source devices (microphones, pickup, etc.), controls the relative volumes of each, and sends a composite signal to the recorder or amplifier unit.

Electronic mixers come in two types, called passive and active mixers. The passive type of mixer is simply a network of fixed and variable resistors, arranged to control the volume of each input signal and to provide reasonably independent blending of the signals into a composite output. Such a simple mixer would have a circuit such as that shown in Figure 1.

The circuit shown is quite practical, and will allow a microphone and pickup to be fed into a normal tape recorder microphone input socket. However, in common with all passive mixing circuits, it possesses a number of undesirable features.

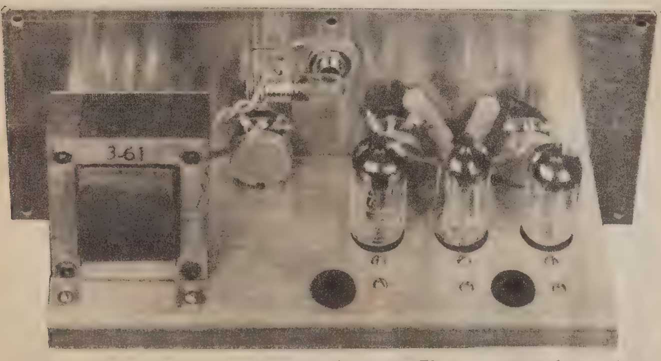
DRAWBACKS

One feature is that the microphone control potentiometer must be kept fairly high in value (here it is 1 megohm) to provide a reasonably good match for the usual crystal microphone. High value potentiometers are often noisy, however, and thus introduce a relatively high noise level into the microphone signal. When used in circuits such as the one shown, where a high gain amplifier follows, the noise is usually too high in level for serious audio work.

The potentiometer cannot be reduced in value, for although the noise might be reduced, so would the bass response of the microphone.

(Readers having relatively low impedance dynamic microphones should note that this does not apply to them. If a dynamic microphone of about 50-100K output impedance is used, the microphone pot, may be changed to 50K or 100K rather than the 1 megohm specified. The simple passive mixer of Figure 1 would then be quite a good proposition apart from the gain problem, which we discuss below.)

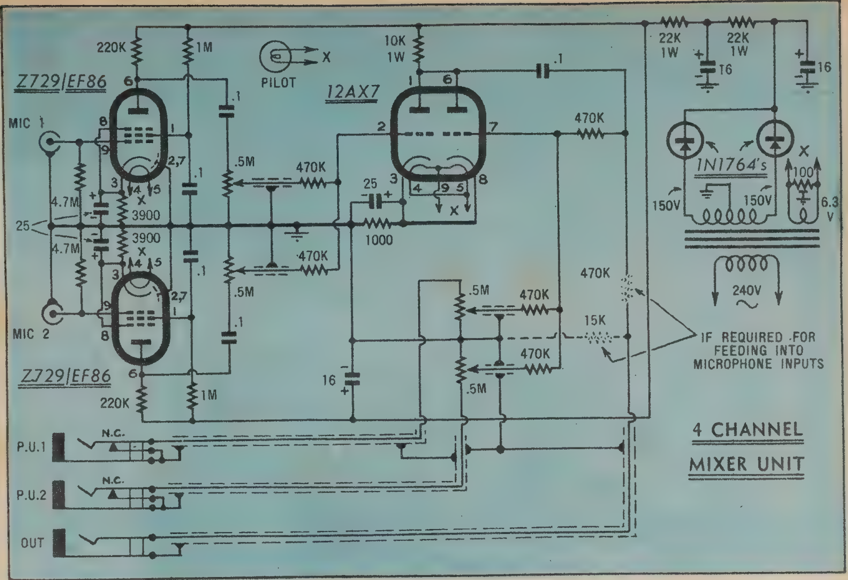
The second problem with passive mixers of this type is that they reduce the volume of the signals passed through them. In the mixer circuit shown, this is of little concern where the pickup input



Here is a rear view of the chassis and panel. The power transformer is on the left, and three valves on the right. Note the microphone pre-amp output coupling capacitors behind the centre valve, and the grommets at the rear of the chassis to take the input and output leads from the rear panel.

is concerned, since it is already reduced in volume by the 470K—22K resistive divider. A little more hardly matters, since the output of the mixer feeds to a microphone input and pre-amp valve.

To the low-level signal coming from the microphone, however, the loss in the mixer circuit becomes embarrassing. Since the mixer loss is about 6 dB (meaning that the output is half the input), this means that the usual tape recorder amplifier will be "flat out" to provide enough volume. Some recorders may manage to compensate for the loss, but many will not be able to do so, unless modified in some way, with consequences as before.



The circuit of our new mixer reveals that it is quite simple in design. Using but three valves and two silicon diodes, it is most economical to build, yet offers full mixing facilities. Note the divider resistors (shown dotted) required if a low level output is needed for a microphone input.

Thus the question of whether such a passive mixer will serve your purpose will depend for its answer upon many factors. These include the recorder or amplifier used and its gain, the microphone used, the nature of the sounds recorded (close talking or distant sounds, etc.), and the final quality tolerated. Remember also that simple passive mixers such as that shown will cater for only two input signals if satisfactory mixing is desired.

Because of the disadvantages inherent in passive mixers, the active type of mixer is usually preferred. With this in mind, we have developed a four-channel active mixer unit, which is presented on these pages. Reference to the circuit diagram will show the principle features of the active type of mixer, compared with the passive type shown in Figure 1.

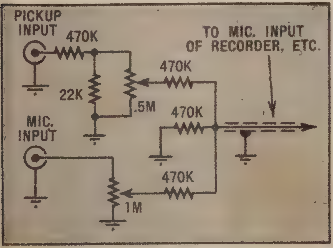


Figure 1: The circuit for a simple passive mixer unit which may give reasonable results with a crystal microphone and pickup. It should be built into a small shielded box to prevent hum pickup. The text explains why this type of mixer is not favoured for serious audio work.

Firstly, before the actual mixing and volume control operations take place, the low-level microphone signals are passed through pre-amplifier stages. These stages (using the two Z729/EF86 valves) raise the signals to about the same level as pickup signals (about 500 millivolts) and allow mixing to be done in medium impedance, high-level circuitry. Thus the noise level is kept to a minimum.

The actual mixing is done, as before, by a fixed resistive network. Each signal is controlled by its own volume control potentiometer. Fixed 470K isolating or "adder" resistors placed in series with the moving arms of the pots. prevent the controls affecting the other signals to any extent.

Since this type of network cannot deal satisfactorily with more than two input signals, another type of signal mixing is employed—electronic mixing. A twin triode valve is connected with its two plates and cathodes connected together. It thus behaves as a single triode valve having two control grids and will mix signals applied to its grids, while keeping them separate, as far as their sources are concerned.

Thus the final mixer unit uses resistive mixing to combine the two microphone signals, resistive mixing to combine the two pickup signals, and electronic mixing in the 12AX7 valve to produce the final composite output signal.

Since the 12AX7 valve is connected up as a triode amplifier stage, it is capable of increasing the level of the signals. Here is another advantage of the active type of mixer, for the mixing triode valve can be used to compensate for the loss in signal level caused by the resistive mixing circuitry.

With the circuit as shown, the gain in the 12AX7 valve raises the output signal to the level of the pickup input signals—approximately 500 millivolts. Thus the output is suitable for direct connection to the pickup jack or terminals of any radio, amplifier, recorder or film projector.

If the recorder or amplifier used has only a microphone input connector, the output of the mixer will have to be reduced in level. This may be done by adding the two resistors shown dotted on the circuit diagram, which constitute a voltage divider.

To sum up our preliminary discussion, then, here are the main features and advantages of the active type of mixer unit: It has in-built microphone pre-

PARTS LIST

1 Wooden case as per diagram.
1 Panel and chassis to suit.
1 Connector panel, ditto.
1 Power transformer, 150-0-150V at 30 MA. with 6.3V at 1.8A
1 Pilot lamp and bezel.
3 Miniature 9-pin valve sockets.
5 5-lug tagstrips (miniature).
2 3-lug tagstrips (miniature).

VALVES AND DIODES

2 x Z279/EF86, 1 x 12AX7, 2 x 1N1764.

CAPACITORS

5 0.1mfd 400VW plastic.
3 16mfd 300VW electrolytic.
3 25mfd 12VW electrolytic.

RESISTORS

2 x 3.9K ½ watt; 1 x 1K ½ watt;
1 x 10K 1 watt; 2 x 22K 1 watt;
2 x 220K ½ watt; 5 x 470K ½ watt;
2 x 1 meg ½ watt; 2 x 4.7 meg ½ watt;
1 x 100 ohm w.w. slider pot;
4 x 500K log. carbon pots.

SUNDRIES

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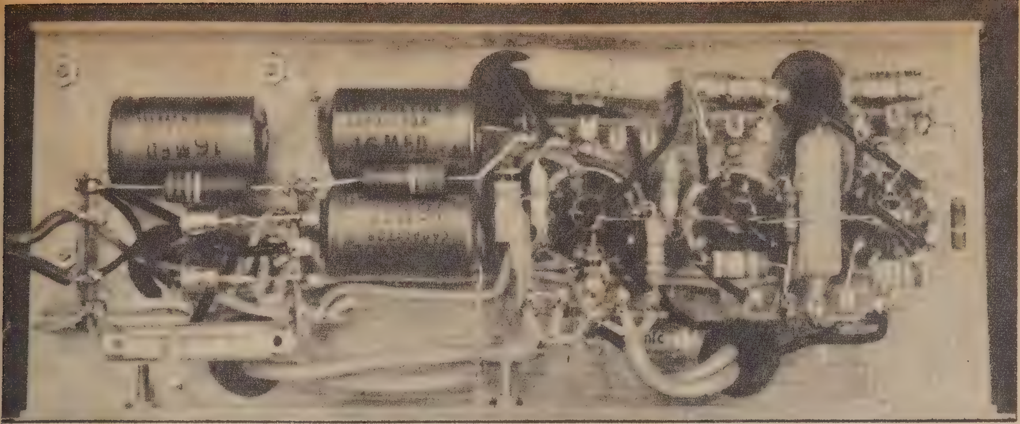


Here is the underchassis view of the mixer unit. Note the use of a common earth line running between the valve socket centre spigots. This is used to earth all the valve circuitry, and connects to the chassis at one spot only—the centre lug or "foot" of the tagstrip in front of the 12AX7 socket. The 12AX7 is the valve closest to the centre of the chassis, with the two Z729/-EF86 valves furthest from the power transformer.

amplifiers, mixes the signals at a relatively high level to reduce noise and does not introduce a signal loss.

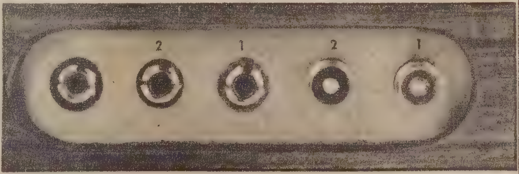
The disadvantage usually pointed out for active mixers is that they are more expensive than passive types. This is true, but an active mixer provides a greater ease of operation and produces far better results.

This being the case, we feel quite justified in presenting the mixer unit shown on these pages. Catering for two microphones and two pickups, it is self-contained and features low noise and distortion with a frequency response flat over the entire audio spectrum (3dB down at 25 c/s and 27 Kc/s).

The unit employs only three valves, two silicon diodes and a minimum of components. Power is obtained from a miniature 150-0-150 volt transformer.

As mentioned in the preamble, two Z729/EF86 valves are used as the microphone pre-amplifiers. They are connected as conventional pentode amplifiers, and have an input sensitivity of approximately 4 millivolts (full volume) for a mixer output of 500 millivolts. This means that they will cater for most crystal and dynamic microphones, and many ribbon microphones when used with a step-up transformer.

This view shows the rear panel mounting the input and output connectors, simply a sheet of aluminium measuring 6¾ins x 2¼ins.



The outputs of the microphone preamps are controlled by 0.5 meg log. carbon pots, which are also employed in the pickup input circuits. Thus each input signal has its own volume control, independent of the other signals.

From the resistive mixing circuitry, the signals pass to the grids of the 12AX7 mixer triode. There they are amplified, and the final signal appearing at the plate is a composite of all the inputs. A 470K resistor from the plate to the pickup signal control grid introduces negative feedback to keep gain and noise to a minimum and to improve frequency response.

The output is taken from the 12AX7 plate via a 0.1 mfd capacitor and fed to the output jack. If a low level output is required, for feeding into an amplifier having only microphone input, the output may be reduced by the addition of two resistors (shown dotted).

Power supply for the unit, as mentioned, involves a miniature 150-0-150 volt 30-milliamp transformer and two 1N1764 silicon diodes in a full-wave circuit. A two-stage resistance-capacitance filter provides adequate HT filtering but adds little to the overall bulk of the unit.

To reduce hum to a suitable level, the heater supply is balanced with respect to earth and is provided with a slider potentiometer (100 ohm) to allow hum-backing to be performed. The technique of single-point earthing is used in the amplifier circuitry to further reduce hum with the result that the final (hum plus noise) figure is 60 dB below the reference output level of 500 millivolts. This is low enough to be negligible in all but highly critical applications.

Physically, the mixer unit is constructed on a simple panel-and-"U" chassis assembly mounted in a small wooden carrying case. The four volume control potentiometers are mounted centrally along the front panel, with the mains pilot lamp near the top of the panel.

As the rear view of the chassis shows, the miniature power transformer is mounted at the rear of the chassis at one end. The valves are mounted at the other end along the centre of the chassis, with the two Z729/EF86's furthest from the power transformer.

The input connectors and output jack

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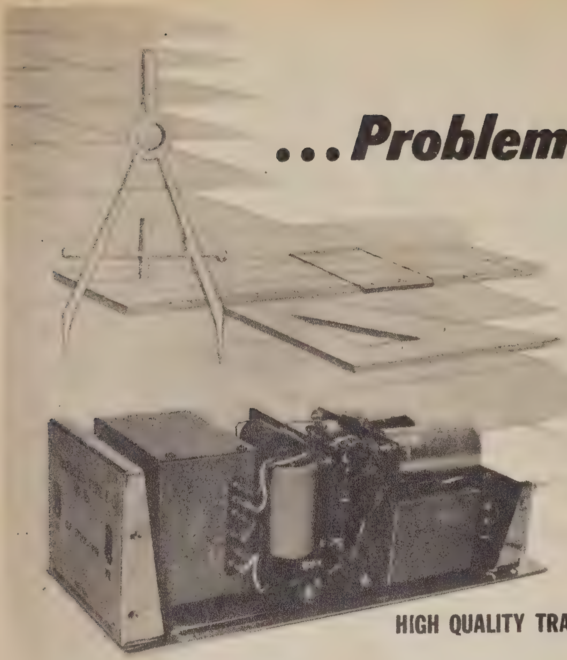

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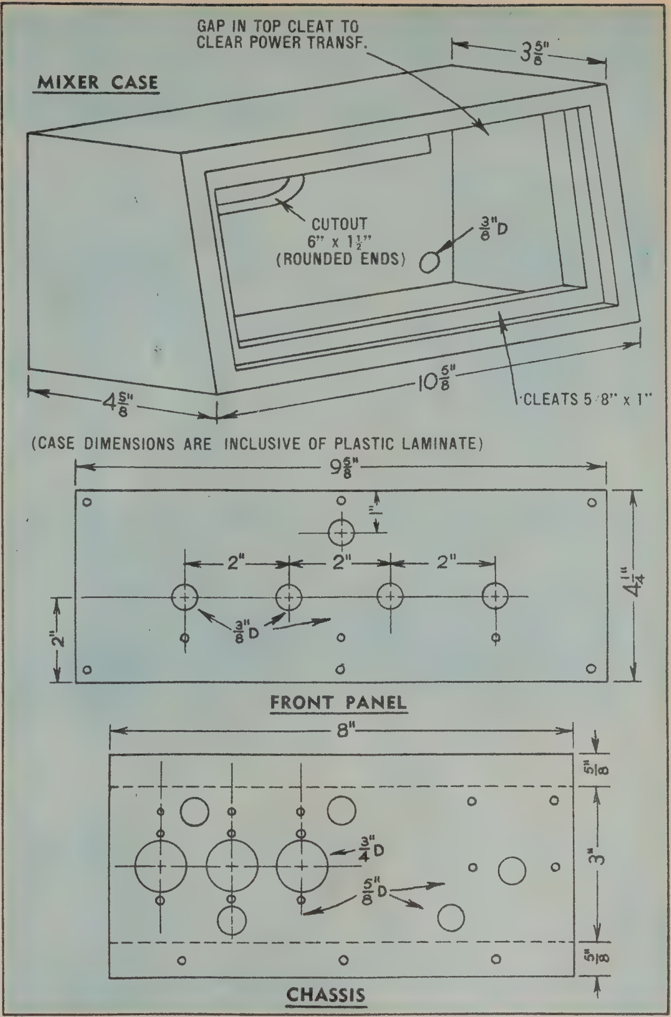
are mounted on a small aluminium plate, which is screwed behind a hole in the rear of the case. This keeps the connections to the unit away from the operating knobs, and simplifies operation. The use of an output jack rather than a captive output cable necessitates the use of an output cable having a plug at each end, but it has the advantage that the mixer does not have a bulky cable permanently attached.

This cannot be done easily in the case of the mains cord, but since a two-core flex is used, little bulk is added. The mixer is not eathed directly to the mains but connects via the shield braid of the output cable. This ensures that multiple earths do not occur, with consequent hum troubles.

Underneath the chassis, two miniature 5-tag strips directly under the power transformer support the mains termination and transformer connections. The strips also support the silicon diodes, the 100-ohm slider potentiometer and the first 22K filter resistor.



This sketch shows the dimensions of the case, panel and chassis used for the prototype mixer unit. We finished the chassis and panel with a matte surface, by brushing the aluminium and spraying with clear laquer. The matte surface blends well with the dark, polished surface of the plastic laminate, giving a professional finish to the unit.

The three high-tension electrolytic capacitors fit close to the chassis between the power supply circuitry and the 12AX7 socket. The circuitry for this valve is supported by miniature 5-tag strips to the front and rear of the socket. The front strip anchors the mixing resistors and the cathode components, while the rear strip handles the output components.

The components associated with the two microphone pre-amplifiers are supported by three miniature tag strips. A 3-lug strip at the rear of each socket supports the cathode resistor and bypass capacitor, while a common 5-lug strip mounts the plate and screen circuitry. The coupling capacitors do not mount beneath the chassis, but may be seen above the chassis close to their respective controls.

The main things to watch when wiring up the unit are that the mixer resistor leads are kept as short as possible (the resistors being as close to the 12AX7 socket as possible), and that the common earth of the valve circuitry connects to the chassis at one spot only.

In the prototype, the earth line runs between the three valve spigots. All earth returns for the valve circuitry are taken to this common earth line, which connects to the chassis at one point only —the centre supporting lug of the tag strip in front of the 12AX7 socket.

The carrying case used for the prototype was constructed from half-inch plywood and has a sloping front. Small cleats are fixed to the inside of the case to which the front panel mounts. The case was finished in wood-pattern synthetic laminate of the "Laminex"-"Formica", etc. variety. We are publishing the dimensions of the case for the benefit of readers wishing to duplicate the original.

When applying the laminate, follow the manufacturer's instructions carefully. For best results, cut and trim each piece carefully before you start, undercutting each edge to ensure that it will fit neatly at the corners. When you are satisfied with the fit, apply the contact cement to the case and laminate and wait until both surfaces are practically dry (this normally takes about 20-30 mins.).

When applying the laminate to the case introduce it with a rolling action to prevent air bubbles forming between the two cement surfaces (bubbles would cause bumps and lumps in the finish). Roll the laminate firmly into contact with the case with a rolling-pin or similar device.

Any wood grain visible after the main surfaces have been covered with the laminate should be painted with dark brown enamel to match the laminate. If the operation is performed with care, the case will have a most attractive appearance and will grace the most elaborate audio setup.

This completes the description of our four-channel mixer unit. Small in size and cheap in cost, it will allow quite elaborate mixing to be done with the most modest of audio equipment.

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SINGLE BURNER STOVE

The safest, fastest, simplest picnic stove ever. Simply attach stove to the Gas Pak can and light.

Price 57/6

TWIN BURNER STOVE

Stove measures 14½in x 5½in x 4½in. Lightweight, easy to operate.

Price £5/19/6

NOW! DO 101 JOBS WITH GAS PAKS

Simple to use. Cans are self sealing, cannot leak or spill.

GAS PAK CANS

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Gas Pak Cans are speedy, safe and simple to use, with all Gas Pak appliances.

Price only 6/11 ea.

T.O.A. TRANSISTOR MEGAPHONES OR LOUD HAILERS

These are the ideal portable amplifier and speaker combination for use at sports meetings, on board ships, at schools, etc. Two types are available, both are transistor-powered with (5) transistors and operate from (4) torch cells.

Model ER 301	**Gun Type**
Voice range	1,000 yards.
Output	Maximum of 8 watts.
Battery Life	15 hours.
Batteries used	4 standard torch cells. Eveready type 950 or D50.
Dimensions	Diameter 7-3/8 inches. Length, 12-5/8 inches.
Weight	4 lbs.
Colour	Two-tone, off-white and red.
Price	**£34/5/6 plus 12½% sales tax.** **Total, £38/11/2 plus freight.**

Model ER58	**Shoulder type.** Can be used as a portable or fixed unit
Voice Range	1,000 yards.
Output	8 watts maximum.
Battery Life	15 hours.
Batteries used	4 standard torch cells— Eveready type 950 or D50.
Dimensions	Diameter, 10 inches. Length, 11 inches.
Weight	5.7 lbs.
Colour	Two-tone, off-white and red.
Price	**£39/3/3 plus 12½% sales tax.** **Total, £44/1/2 plus freight.**

WIZARD SIGNAL INJECTOR

Just arrived. Shipment of Wizard Signal Injectors Model ITI-1. This unit is ideal for service of Transistor Radios, Valve Radios, Television Receivers, Amplifiers, Tuners, etc. It produces a signal which makes it suitable for signal tracing in AF, IF and RF circuits, works off 4 penlite cells, has indicator light, measures 1 3/8 x 1¼ x 5in and weighs only 4oz. **Price 1/18/6** plus 12½% tax, or £2/3/6 including tax, plus postage.

PIEZO CRYSTAL MICROPHONES

MODEL LM4. Frequency response 100 to 600 c/s with cord and miniature phone plug. **Price, 18/6 each.**

MODEL BM 3 — (Illustrated). Response 100 to 8000 C.P.S., fitted with 6ft cable and phone plug with on-off switch. Can be used on stand or for hand use.

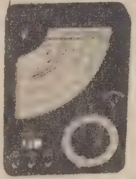
PRICE ONLY 57/6.

MODEL SM2 — (Illustrated). Response 60-8000 C.P.S., fitted with 6ft cable and phone plug. This is a really versatile microphone, suitable for attachment to any stand.

PRICE ONLY 45/-.

MODEL LM1 — Response 100 to 8000 C.P.S. Chromeplated finish with 6ft cable. A very popular model.

Price only 25/-.



WIZARD MODEL 200H MULTIMETER

Ranges:
DC Voltage 0-5, 25, 50, 250, 500 and 2500 volts (sensitivity 20,000 ohms per volt).
AC Voltage 0-10, 50, 100, 500, 1000 (sensitivity 10,000 ohms per volt).
DC Current 0-50 Micro-amps, 2.5 ma, 250ma.
Resistance 0-60,000 ohms 0-6 megs.
Capacitance 10 mmfd to .001 mfd to .1 mfd.
Decibels 20 to 22.
Weight 14oz.
Price only **£5/4/8** and 12½ per cent sales-tax.
TOTAL: £5/17/9, plus Freight.

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All parcels sent Registered Post unless otherwise stated. Postage or Freight must be included with order.

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BRANCHES THROUGHOUT VICTORIA AND RIVERINA

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

EXTRA LOUDNESS FOR STEREO "GIMMICKS"

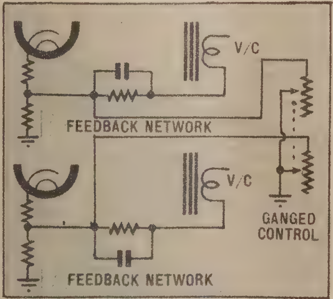
From Mr A. J. Barnes of 11 Wilkinson Lane, Telopea, N.S.W., we have received the following article on obtaining extra volume for effects with stereo records.

WHEN I first heard it said that "you can't tell if a train is distorted," my mind in a split second formed a weird picture of a tangled mess of wrecked locomotive.

We were discussing stereo, of course, and the trend was to sneer at the many demonstration discs or "gimmicks."

Well, our classical collection is not unplayed, I can assure you. To us our "Rheingold" set presents two and a half hours of sheer delight and Kathleen Ferrier's interpretation of Bach and Handel is something that we may not hear elsewhere for a long, long time. I am not too snooty, however, to admit that the locomotives, jet planes and bowling alleys, not forgetting Tchaikovsky's cannon fire, are often put on as interesting novelties and demonstrations of progress in the art of recording and reproducing sound.

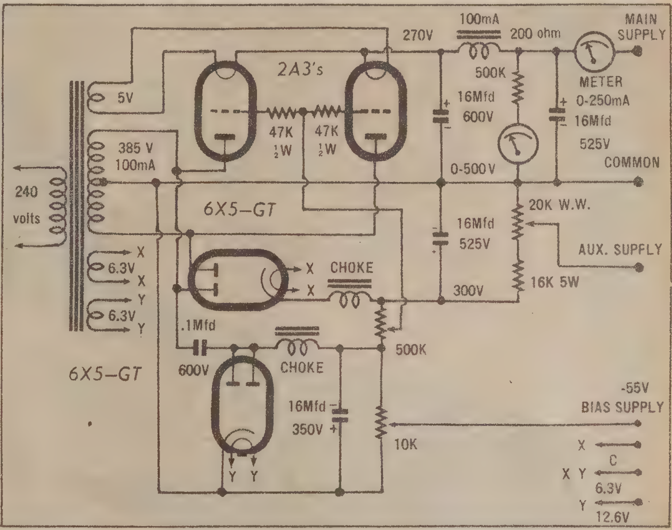
For a truly dramatic presentation of many gimmick tracks a dynamic range far greater than is recorded is often most effective and many audiophiles surreptitiously manipulate the volume control to achieve this end. Just as the locomotive or the jet aircraft is passing through the house maximum loudness makes the effect very real, especially if the demonstration is given in a darkened room.



To gain maximum volume for gimmick tracks where a high degree of fidelity is not required the writer, who uses a "R., TV and H." twin 10-watter with low-output magnetic pickup and preamplifier, has installed a secondary volume control. This control makes available the 20 D.B. or so of gain which is normally lost by the feedback network. A twin 100K pot. has been connected so as to progressively short-circuit the isolating resistors in the cathodes of the input valves in the main amplifier.

The procedure is to gradually advance the normal volume control as the train approaches and when maximum is reached one then continues further with the second control. You will be surprised to note the small audible difference with or without feedback as far as tone is concerned.

ANOTHER VARIABLE SUPPLY UNIT



From Mr R. C. Weelands of 23 Angus Ave, Epping, we have received the circuit and data of a variable power supply slightly more elaborate than the one published last month. In all fairness we must state that Mr Weeland's letter was to hand before last month's issue went to press.

MR WEELAND says: "The idea for this power supply was based on a circuit which appeared in the September, 1952 issue of "Wireless World" in which two PX25's (power triodes) were used as rectifiers. Modifications were made to enable more familiar valves to be used and, in addition, an auxiliary or "screen" supply and a negative or "grid bias" supply were incorporated.

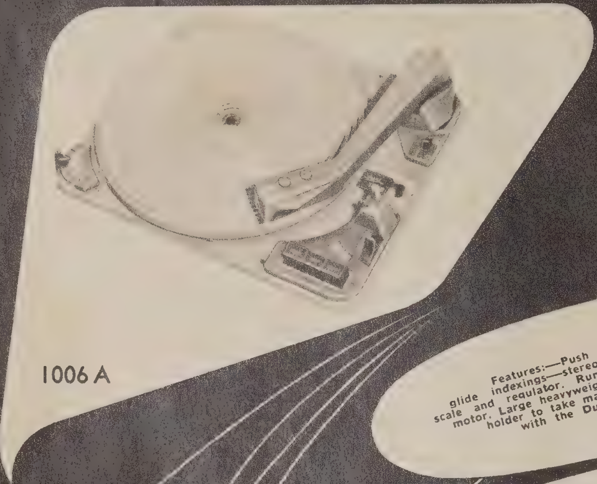
When built as per the circuit diagram it will supply a maximum of 100mA. at 250 volts from the main section, 5mA. at 100 volts from the auxiliary supply and —50 volts (no current) from the bias supply. With no load, the voltage from the main supply rises by some 60-100 volts, depending on the setting of the control. This compares favourably with similar fixed voltage supplies.

In place of the 2A3's, 6V6G's (triode connected) with resistors in the screen leads were tried with similar results. There appears to be no reason why 807s should not be used, though no tests were carried out with this valve.

Resistances of 5K could be used in lieu of the two small chokes in series with the 6X5G's but the chokes are preferable. They were "scramble" wound with 40SWG enamelled wire on 9/16in square cores. The primaries of small output transformers should be satisfactory. The laminations should not be interleaved but assembled to form a small air gap, i.e., butted.

The resistors connected directly to the grids of the 2A3's should not be omitted as, under certain conditions, the grids go positive momentarily. Similarly the first filter capacitor is necessary for correct functioning of the circuit and should not be left out. The use of a much larger capacitor is not recommended, as it may unduly increase the peak current through the 2A3's.

Dual FOR PERFECTION IN MUSIC



1006 A

1006A

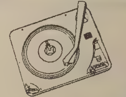
Features:—Push button operation wih roller glide indexings—stereo key—manual key. Built-in weight scale and regulator. Rumble free magnetically shielded 4 pole motor. Large heavyweight turntable. Interchangeable cartridge holder to take magnetic cartridge. Std. model fitted with the Dual CDS420 Stereo Cartridge.

£43/16/-

DMS 900 MAGNETIC STEREO CARTRIDGE

Suitable for Dual 1006A or other systems with std. ½ mounting centres. Frequency range 20-20,000 C.P.S. Minus/plus 3DB. Low compliance. High channel separation. Signal output 10 MV. Fitted with Diamond stylus.

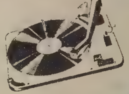
£19/14/6



1007

Features:—Push button control start, stop, repeat. Four speeds. Tone-arm lock. Self-stabilising change spindle. Manual or automatic operation. High fidelity reproductions with Dual pickup system CDS520.

£26/15/-



1008

Features:—Fully automatic with push button control. Four speeds. Intermix of all record sizes. For operation as a changer, automatic player or manual player. Fitted with the Dual CDS520 cartridge. Frequency range 20-16,000 C.P.S. Simple stylus replacement. Tracking weight 5-6 grams.

£31/18/-

WRITE FOR DETAILS

FRED A. FALK & CO. PTY. LTD.,

28 KING STREET, ROCKDALE. Phone LX4783

Distributed by: N.S.W. and Victoria—all leading electrical houses. S.A.—L. S. Wise Ltd., 196 Gilles Street, Adelaide. QUEENSLAND—Ron Jones Pty. Ltd., 1-5 Merton Road, South Brisbane. W.A.—Athol M. Hill, 842 Hay Street, Perth.

FROM THE SERVICEMAN WHO TELLS

IT WAS ONLY A FAULTY FUSE!

How long should it take to replace a fuse in a TV set? In case you're inclined to "stick your neck out" and nominate some typically brief period, I had better point out that there is often a good deal more to a blown fuse than the fuse itself. For one thing, one may have to find and correct the cause. For another, you may strike something like I did recently.

THIS job was one of those unofficial ones which crop up from time to time. In this case a friend of a neighbour approached me late one Saturday afternoon with the usual tale of woe about a set which had just failed, and the rather dreary prospect of an evening without entertainment. (I often try to remember what we did with ourselves on Saturday evenings before we had TV!)

There are many reasons why it may be unwise to become too deeply involved in cases of this kind. For one thing, the set often is still under guarantee and anything but the simplest attention may be risky. One also has to be careful not to poach—or appear to poach—on someone else's preserves.

Nevertheless, it is usually diplomatic to at least consent to look at the set. If it is nothing more than a detached aerial feeder, incorrectly set hold control, or blown fuse, one can usually set things right in a few minutes, with no complications and general goodwill all round.

EXPLAIN THE SITUATION

If, on the other hand, it looks like being a sticky situation, either technically or politically, it is best to explain the situation and bow out gracefully. At least one has made the gesture of trying, which is a good deal better than a blank refusal.

This job looked like being one of the simple ones. A glance into the back of the cabinet revealed a complete absence of heater energy, suggesting a failure in the mains circuit at some point. I assumed it would be a fuse and that the whole job could be completed in a few minutes by simply replacing it.

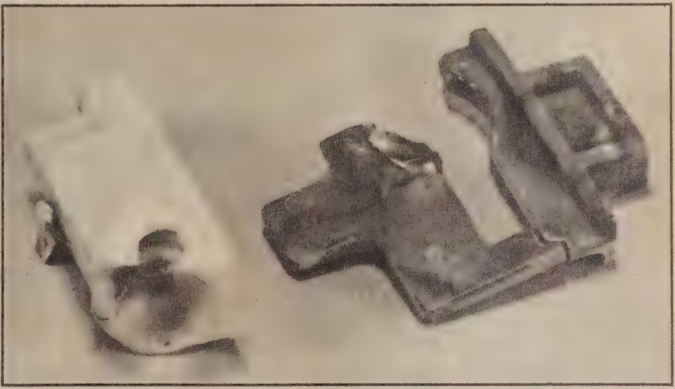
The fuse holder was a popular moulded plastic type, made in two pieces consisting of a main body section fastened to the chassis and a sliding "drawer" section used to insert and withdraw the fuse. Normally, all one has to do is remove the drawer along with the fuse, replace the latter, and push the combination back in again; not more than a minute's work if everything is to hand.

The snag here was that this drawer wouldn't come out. No matter how hard I tugged, I could move only one end of it about a quarter of an inch, while the other end was jammed tight. After several attempts I realised that there was no chance of getting it out short of butchering something.

Fortunately, it was a simple matter to remove the knobs and slide the chasis back a few inches, to where I could see the other side. The photograph gives some idea of what I saw. The holder was still in one piece, but a grotesque bulge at one end showed why it had jammed. I assumed, correctly as it turned out, that whatever had damaged the body of the unit had similarly damaged the drawer section.

It was now obvious that the holder was a write-off. There was little point in worrying about getting it open since it would have to be replaced anyway. And, fortunately, I realised I had a replacement on hand, one that I had brought home for a not-very-urgent private job.

But there was more to the problem than this. I wanted to be sure that I knew why the damage had occurred and could take reasonable steps to see that it did not occur again. The first part was easy, but quite intriguing, and an excellent example of how easily a good idea can go wrong.



Even though I had to break this holder to get it apart, some idea of the distortion due to heat can be gained from the picture. Note particularly the bulge in the drawer section, which effectively jammed it.

In the power transformer primary circuit of this particular receiver there is a thermistor, a negative temperature coefficient resistor used to limit switch-on surges caused by cold heaters, etc. I imagine it was intended to afford some protection for the heaters, particularly the picture tube, as well as to minimise blown fuses due to switch-on surges. The latter can be a very serious problem where a fuse is rated low enough to be of real value.

This, in itself, was a very good thing, the only snag being the location of said thermistor. It was mounted between two lugs on the fuse holder—one active, one blank—and located underneath the fuse holder. To be sure, there was a clearance of an inch or two between the units but, on the other hand, thermistors get really hot; they have to, it's their mode of operation.

It looked like a pretty clear cut case. Heat from the thermistor had softened the plastic, causing the present condition either directly, or indirectly by causing poor contact inside the fuse holder. The lattter would cause local heating, still poorer contact, more local heating, and so on.

More important, at the moment, was what to do about it. I felt I should do what I could to prevent a recurrence of the trouble, even though it might involve a minor change in layout. At the very least, it seemed worthwhile to try to mount the thermistor above the fuse holder rather than below it, and a preliminary survey suggested that this could be done.

So, out came the old holder and in went the new one. (The old one was still intact at this stage, but was subsequently broken open in an effort to confirm what had happened.) In fitting the new one it was necessary to invert it relative to the old one, thus bringing the contacts above the drawer section where they would be suitable for the new thermistor position.

This could have been awkward, because the mounting holes in this type of holder are not exactly central and, strictly speaking, should not have lined up when the holder was inverted in the rectangular cut-out. Fortunately, the latter was a trifle oversize and I was able to get away without the need for filing, etc., which would have been inconvenient, to say the least.

For the rest, it was simply a matter of restoring the old connections, inserting a new fuse, and the set was back in operation. The only catch was that it had taken me a good deal longer than is normally required to replace a fuse.

Also, I felt I wanted to know more about this particular fault. Was this merely an isolated case, due perhaps to incorrect assembly? Or was it a fundamental fault and, if so, did the manu-

National 27 Mc/s Transceiver

As Mr. W.N. Williams pointed out in last month's R.T.V. & H.", the "Citizens Band" is not yet here, but the P.M.G. will grant licences for 27 Mc/s transceivers to people who can establish a legitimate need.

And the model EK611, manufactured by National, already the leading producer of domestic transistor radios, is the obvious choice for quality and convenience.

£47/10/0

(including tax) with leather case, batteries and whip aerial.

Sole Australian distributors

WESTON Electronics Pty. Ltd.

77 Sydenham Rd., Marrickville, N.S.W. (51-5433).
SALES OFFICE: 469-475 Kent St., Sydney. (MA8411).

Range—to 6 miles over water.

Weight—1.1lb complete.

Perfectly balanced with controls placed for one-hand operation.

Light but strong metal case.

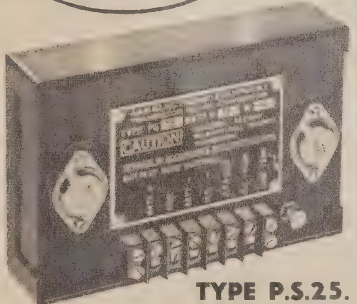
Fully transistorised.

Approved by P.M.G.

ELECTRONIC A&R EQUIPMENT

NEW RELEASE! NEW LOW PRICE! LIGHTWEIGHT EFFICIENT

TRANSISTOR D.C.-D.C. CONVERTER



TYPE P.S.25.

The ideal Power supply for Private or Commercial use—the P.S. 25 Transistor D.C.-D.C. Power Converter is quiet in operation, lightweight, efficient and fully laboratory tested. The Unit comes complete with full instructions, circuit and connection diagrams, and will be available from all A and R Stockists by Mid-November!

Input Volts	12-14v. D.C.
Output Power	45 Watts maximum.
Input Current	4.45 Amps (13v. in, 45w. out.)
Output Voltage 13v. in	300 & 150v. simultaneously
Output Current	130mA. Continuous (40 watts) 150 mA. Part intermittent (45 watts)
Efficiency at full output	78%
Frequency operation	1400 c/s approx.

Maximum Operating Temp.—150° F. (approx. 65° C.) (i.e.) Ambient air temp. at point of installation)

Filtering: "HT + High"—50 mV or 0.02 % ripple.
"HT + Low —requires external filtering.
L.T. and H.T. filtering includes suppression of harmonics allowing use of converter on sensitive receivers.

Dimensions: 6in x 4in x 1½in approx.

Mounting: 4-hole rear mtg. Complete Unit easily removable from mounting base.

See your nearest "A. & R." Distributor . . . .

VIC.: J. H. Magrath, Radio Parts, Motor Spares, Warburton Franki, Howard Electrical and Radio Co., Douglas Radio.
N.S.W.: Watkin Wynne (Factory Reps.) and available at all leading Stockists.
W. AUST.: A. J. Wylie (Factory Reps.), Atkins Ltd., Carlyle and Co.
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A. & R. ELECTRONIC EQUIPMENT CO. PTY. LTD. *378 St. Kilda Road, Melbourne, S.C.1. MX 1150, MX 1159* facturer know about it and had a modification been suggested?

While I had serviced a number of these receivers in the past, I had never encountered any trouble in this part of the circuit and, in fact, had never taken a great deal of notice of it. I decided it would be a good idea to find out all I could about the problem at the first opportunity.

A few days later, during a slack period in the workshop, I took the opportunity to telephone the service department of the firm concerned, and put the problem to them. They were very helpful and, as I half suspected, already knew all about the problem and had issued a routine modification note to cover it.

ESCAPED THE NET

In fact, only a small batch of receivers had been released before this defect had been discovered, and many had been recalled, or modified by dealers before sale. Of those already sold, a good many had been subsequently modified by dealers, either during the course of other maintenance work, or simply as a precautionary measure. The one I had encountered apparently was one of the few outstanding units which had escaped the net.

In regard to the actual fault, they confirmed that it was due to the heat from the thermistor, but were less inclined to support my theory about radiated heat and the position which the thermistor occupied. Tests in their own laboratory had shown that most of the heat had reached the holder by conduction through the thermistor leads, and thence to the fuse clips.

For this reason their modification had been more drastic than mine; the thermistor had been moved right away from the fuse holder and mounted on the lugs of the volume control switch. This had completely cured the trouble.

However, I learned that the fuse holder manufacturer had also shown some interest in the problem and had subsequently modified both the plastic from which the unit was moulded, and the material from which contacts were made, the latter, presumably, to provide better temper and less risk of poor contact under typical high ambient temperature conditions.

I also gathered that my case, while not unique, was relatively rare. More normally the trouble became evident earlier, but in a less drastic form, by simply open-circuiting the fuse contact and putting the set out of action. While just as annoying from the customer's point of view, it did at least avoid the costly repairs involved in my case.

Summing up then, the trouble was basically due to the mounting of the thermistor on the fuse holder. My own modification, while on the right track, just wasn't good enough. While I don't imagine any serious damage will have been done so far, I will have to pay another visit to that set as soon as possible and do the job properly.

And finally, what of the original fuse? Had it failed or was it simply poor contact? I broke open the damaged holder and found that it was, in fact, blown. Since there was nothing obvious wrong with the set, I can only assume it was, like so many others, simply a case of fuse fatigue.

On quite another aspect of TV, have you ever wondered what it is like to drop a picture tube?

I'm afraid this prospect has always held a morbid fascination for me; something akin to the feeling one gets when looking over The Gap. Commonsense tells us that if we jump we will be killed, yet curiosity extends a strange temptation to go ahead, just to find out what it's like. Fortunately, few of us succumb to the temptation, either at The Gap or in the workshop.

Nevertheless, I have often been tempted to take an old tube out in the bush and drop it over a convenient cliff, just so that I could watch the reaction from a safe distance. Perhaps I will one day.

In the meantime, I recently experienced the next best thing; a first-hand account by a colleague who dropped one —and not over a cliff either, but in the customer's loungeroom!

Just why it happened he is not quite sure, except that it was late in the evening, he had had a hard day, and the atmosphere in the flat was a bit hectic. There were four small children, who were supposed to be in bed, and a harassed mother who was trying to keep them there. At regular intervals they invaded the loungeroom, only to be repelled by a verbal onslaught which grew louder and higher pitched each time.

Then there was Pongo. Pongo was a nondescript canine, who insisted on sleeping on the loungeroom floor, right where my colleague had to step over him everytime he moved from the front to the back of the set.

Small wonder that he was feeling a bit edgy on it.

Nevertheless, he removed the old tube and transferred the harness to the new one, which was face down on a rug on the linoleum. Then, with everything ready he bent down and picked up the tube. At that moment the young fry decided to make another assault on the loungeroom. Mum saw them and lashed out with a broom and suitable threats. My colleague's attention was distracted for a moment and the next thing he knew the tube was slipping.

QUICK DECISION

He had to make a quick decision. To try to save it meant putting himself in such a position that, if he failed, he would be lying almost on top of it when it went off. The alternative was not to try, and to take a chance on lesser injuries. In a split second he made his choice; let it go and hope for the best.

He spun round, his back to the tube, hands flying to his face.

BOOM! With a roar like a small cannon the tube imploded. As it did so my colleague had a fleeting glimpse of Pongo, fully airborne, hair on end, legs stiffly extended. He had gone straight up like a flying bedstead as the tube landed.

The next few moments were pretty chaotic. Mum screamed, father swore, and Pongo, who had finished up on one of the lounge chairs, squatted on his haunches, threw back his head, and howled like a banshee. Neighbours, alarmed at the report, came rushing from adjoining flats to find out what had happened.

When my colleague could collect his thoughts he made a quick check of his own person, discovering with relief that

(Continued on Page 81)

COMMUNICATIONS RECEIVERS

To Suit Your
— BUDGET —

TRIO MODEL 9R-4J

MADE IN JAPAN

FREQUENCY RANGES:	A. 550-1600 Kc/s B. 1.6-4.8 Mc/s. C. 4.8-14.5 Mc/s D. 11.0-30.0 Mc/s
I.F. CHANNEL:	455 Kc (2-stages)
SENSITIVITY:	13uV (S/N 20 db input at 10 Mc)
SELECTIVITY:	60DB (at 1 Mc plus minus 10 Kc)
AUDIO OUTPUT:	1.5 watt.
POWER CONSUMPTION:	50Va, 50-60 C.P.S. 240 V. A.C.
VALVE LINE-UP:	6BD6 R.F. 6BE6 Mixer. 6BE6 Oscillator. 6BD6 1st and 2nd I.F. stages. 6AV6 2nd Detector. 6AR5 Audio Output. 5Y3GT Rectifier. 6AV6 ANL and BFO.
DIMENSIONS:	8in high x 15in wide x 9in deep.
WEIGHT:	19.3lb.

THE TRIO 9R-4J COMMUNICATIONS RECEIVER IS THE VERY NICEST LITTLE RECEIVER AT A PRICE WITHIN YOUR BUDGET

Price – £78

INC. SALES TAX (Freight Extra)

The **TRIO 9R-4J** has bandspread tuning with a large logging scale. In addition to the main tuning and bandspread controls it has "on-off volume," "on-off ANL," "BFO, MVC and AVC Switch," "Band Change Switch," "IF Gain Control," "Standby-RX Switch," "BFO Pitch Control" and "S-Meter with Zero Set Control. Each receiver delivered with full instruction manual including alignment instructions and circuit diagram. External speaker (not included with 9R-4J) is required with 7K ohm plate-to-voice coil transformer.

Jelectro Model RX-59

(Made in Japan)

FREQUENCY RANGES:	A. 550-1600 Kc/s. B. 1.6-5.0 Mc/s. C. 5.0-14.0 Mc/s. D. 11.0-30.0 Mc/s

Bandspread Dial clearly marked to show amateur band coverage, plus convenient 0-100 logging index for shortwave listening.

IF CHANNEL:	One Stage 455Kc.
SENSITIVITY:	All band coverage, 3uV (S/N 10DB Minimum, 30 p.c. modulated)
AUDIO OUTPUT	2.5w into 3.2 ohms, 4in speaker.
POWER CONSUMPTION:	55w, 50-60 C.P.S. 240 V. A.C.
VALVE LINE-UP:	6BE6 Converter. 6BA6 IF Amplifier, "S" Meter amplifier and Autodyne BFO. 6AV6 Detector, 1st Audio 6AR5 Power Amplifier 6X4 Rectifier.

PRICE—£55

INC. SALES TAX (Freight Extra).

Jelectro QRP-60

Companion Transmitter

BAND COVERAGE	80, 40, 20, 15 and 10 metres.
OPERATION:	Xtal Control with provision for plug-in VFO: built-in screen modulation: Pi-network output coupling 50 to 1,000 ohms impedance.
VALVE LINE-UP:	6CL6 Oscillator. 6DQ6A Power Amplifier. 12AX7 1st Audio amplifier 12AU7 Parra. Modulator. 5U4GB Rectifier.
OUTPUT:	60 watts CW—50 watts phone.

PRICE—£60

INC. SALES TAX (Freight Extra).
THE WORLD'S SMALLEST 60W TRANSMITTER. VISIT OUR NEW SHOWROOMS.

William Willis & Co.
PTY. LTD.
428 Elizabeth St., Melbourne
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BATTERIES

This article, reprinted from Electronics World (October 1961) is an excellent summary of the various types of batteries currently in use in the U.S.A. It is aimed, apparently, at correcting some of the customer confusion which has arisen as a result of the wide range of types available. While not all the types referred to are available in this country at present, it gives an excellent picture of what we might expect in the future.

*** By D. B. Cameron**

SELECTING a battery for a radio or instrument is not merely a dollar-and-cents decision. Proper choice from the many types now available can have a marked effect on the operation of the device and on the user's satisfaction and convenience. Every battery type and electrochemical system offers certain advantages and limitations. A general understanding of battery characteristics can eliminate confusion and permit a wise selection.

Prior to World War II, practically all primary batteries were the LeClanche or carbon-zinc type. Both flat and cylindrical cells were available, but choice of a battery for a particular use presented few problems. Wartime military requirements stimulated fantastic advances in electronics and created a need for specialised battery-power sources. Battery research and development efforts mushroomed. Efficient miniature carbon-zinc batteries became practical, and new electrochemical systems were evaluated. The mercury battery system was one result of this research.

FURTHER PROGRESS

In the years since the war, these efforts have continued. The mercury battery system and miniature carbon-zinc batteries were perfected, the transistor was developed, and battery-operated devices, from toys to radios, gained wide consumer acceptance. The need for compact, efficient, economical batteries has now brought two additional electrochemical systems into use: high-energy alkaline manganese batteries and sealed nickel-cadmium rechargeable batteries.

The owner of a pocket radio powered by penlite cells has a problem. Shall he use standard flashlight cells, radio-type carbon-zinc cells, mercury batteries, alkaline-manganese energisers, or nickel-cadmium batteries? For example, there are eight different "Eveready" brand penlite cells, each designed for a particular use. The multiplicity of battery types has caused confusion. Has there also been progress?

Almost everyone, even a child, recognises a battery and considers it a very simple device. Appearance can be deceptive. A battery is actually a small electrochemical plant. It must do nothing until power is needed and yet must start operating instantly when an electrical connection is made. It must operate in any position and withstand rough handling. A modern battery must be compact, efficient, foolproof, attractive, and economical; and it must operate under all sorts of adverse conditions.

Consider the characteristics that would be desirable in an ideal battery: long shelf life, high energy, good light-drain performance, efficiency on heavy-drain use, reliable intermittent operation, good continuance service, high amperage, low impedance, high-temperature stability, low-temperature capabilities, constant voltage, rechargeability, small size, freedom from leakage, attractive appearance and last but not lest, it must be inexpensive.

Unfortunately, it is not yet possible to maximise all of these characteristics in a single battery. In order to supply each type of user with the best possible battery for his particular application, a battery manufacturer must produce a number of different batteries of the same size and shape, each tailored to maximise the most essential characteristics for a specific end use.

To obtain the best battery value and satisfaction, the consumer or the professional who advises and supplies him, should understand at least the basic characteristics of the new batteries now available.

Carbon-zinc and mercury batteries have been in use long enough for most interested technical people to have a general appreciation of their characteristics. The carbon-zinc system is the workhorse of the industry. These batteries have the widest availability, a broad range of desirable characteristics, and the lowest initial cost. Mercury batteries provide longer life, a more constant voltage, and lower impedance—but at a higher price. What do the alkaline-manganese and nickel-cadmium batteries offer?

Alkaline-manganese batteries have a total energy almost equal to mercury batteries and they are capable of delivering their rated capacity even on heavy continuous drains where both the carbon-zinc and mercury systems become inefficient. Furthermore, this newest electrochemical system provides high amperage, low impedance, outstanding temperature characteristics, and good shelf life at a price between carbon-zinc and mercury battery cost.

The sealed nickel-cadmium system permits a maintenance-free battery that can be recarged hundreds of times and can be left discharged without damage. Unfortunately, practical areas of use are limited by high initial cost and by the fact that energy-per-charge is often much less than a primary battery can supply.

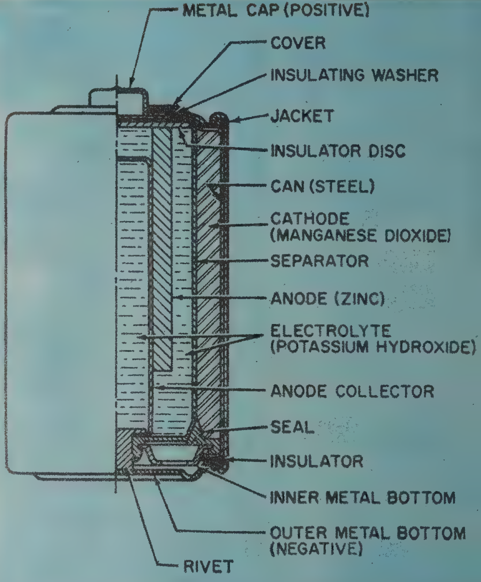

Fig. 1. Cut-away illustration of alkaline manganese cell.

A discussion of battery performance and applications will help clarify the relative merits of the alkaline-manganese and nickel-cadmium battery systems.

The alkaline primary battery differs from the conventional LeClanche cell primarily in the highly alkaline electrolyte used. The cell is a high-rate source of electrical energy. Its outstanding advantages are derived from the unique assembly of components and construction methods. See Fig. 1.

Two principal features are a manganese dioxide cathode of high density in conjunction with a steel can which serves as a cathode-current collector and a zinc anode of extra high surface area in contact with the electrolyte. These features, coupled with the use of a potassium hydroxide electrolyte of high conductivity, give these cells their very low internal resistance and impedance and high service capacity.

The cells are hermetically sealed and encased in steel, providing virtually a leakproof package. Each cell is a nominal 1.5 volts. The ampere-hour capacity is relatively constant over a range of current drains and a range of discharge schedules.

The primary advantage of the new system lies in its ability to work with a high degree of efficiency under

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★ Manager, Sales Engineering, Union Carbide Consumer Products Co., U.S.A.

continuous or heavy-duty, high-drain conditions where the standard round cell is unsatisfactory. Under certain conditions the new alkaline cells will provide more than ten times the service of standard round cells. Heavy current drains and continuous or heavy-duty usage impair the efficiency of the conventional carbon-zinc cell to the extent that only a small fraction of the built-in energy may be removed.

On light drains, such as portable radio or instrument use, alkaline-manganese cells often supply more than twice the service life (Fig. 2) of carbon-zinc batteries and very nearly equal mercury battery life. The low impedance of alkaline cells can improve radio performance by minimizing distortion and their low temperature characteristics result in good service life even under outdoor winter conditions.

The good low-temperature performance of alkaline-manganese batteries completely overcomes the temperature limitations of mercury batteries and far surpasses standard carbon-zinc cells. At light to intermediate drains, reasonable service can be obtained at —40 degrees F and below. This characteristic is particularly valuable in devices which may be stored or operated outdoors or in automobiles in winter.

MANY ADVANTAGES

The heavy-drain, high-amperage performance of alkaline-manganese batteries makes them particularly useful in toys and for photographic and hobby use. These cells will make practical completely new types of battery-operated equipment.

The E94 alkaline energiser is a new cell size. The diameter is the same as a "D" cell but it is only one-half the height. Two E94 cells will fit in a holder designed for a single "D" cell. Where it is desirable, and the device will stand the higher voltage, it is now possible to double the voltage in existing "D"-cell-powered units.

The smaller alkaline cell has a service capacity equal to a standard "D" cell on heavy continuous drains. For example, four "½D" cells can be placed in a standard 2-cell torch. If the usual PR-2 lamp is replaced by a PR-13 lamp, designed for the higher voltage, the light output will be doubled. The brilliance will approach that of a 5-cell spotlight.

The E93 "C" size alkaline energizer, like the other alkaline-manganese cells, on heavy continuous drains will supply up to 10 times the life of a comparable carbon-zinc torch cell.

Its first use was in the "Futuramic II" electronic flash unit manufactured by the Heiland Division of Minneapolis-Honeywell Regulator Company. The high energy and high amperage of the alkaline energizers made them idal for this application.

Electrically powered toys are very hard on batteries because drains are heavy and the smallest possible cells are usually used. The majority of toys use "A.A." or "C" size cells. The heavy drain capabilities of alkaline-manganese cells make them ideal for this use. They not only last several times as long as torch batteries, but they often improve toy performance as well.

HEAVY DUTY TYPES

When currents of one ampere or more are required for periods of several hours, larger alkaline-mangantse cells must be used. Both "D" and "G" size cells are available, the latter both as a unit cell and series-connected to form the 6-volt No. 520 battery. Although the "G" size cell with insulated terminals ("Eveready" No. E97S) is about one- sixth the size and one quarter the weight of the No. 6 cell used in the hobby field, it gives over 70 per cent of the service of the No. 6 cell in glo-plug ignition operation for model aircraft engines.

In addition to electronic, toy, hobby, and other heavy-duty uses, the E95 "D" cell and the 6-volt battery (No. 520) are particularly adapted for emergency lighting use. Emergency lanterns must be capable of supplying a bright light (high-drain bulb), they must be capable of continuous operation for the duration of the emergency (possibly many hours), and they must operate under adverse temperature conditions. Furthermore, the batteries must have a good shelf life so they will be capable of operation when an emergency occurs. There requirements spell out the important characteristics of alkaline-manganese cells. The torch in a car is an emergency light—and in winter it must be capable of opertaing when cold!

The initial cost of alkaline-manganese batteries falls between that of carbon-zinc and mercury batteries. On all tests they deliver more service than carbon-zinc batteries and on heavy-drains or in low-temperature uses, service of alkaline-manganese batteries will exceed mercury batteries. Unless a flat discharge curve is essential, the cost-per-hour operation of alkaline-manganese cells is lower than for mercury batteries.

It is also lower than carbon-zinc batteries in heavy continuous use, but may be somewhat higher in light intermittent uses. In some cases, superior electrical device performance, resulting from the better shelf life and lower impedance of alkaline-manganese batteries, may offset any increased operating costs.

In the realm of rechargable batteries there are other factors to consider. At first glance a rechargeable power source appears to offer the convenience of primary battery operation without the expense of replacement batteries. In some circumstances, this could be true and a rechargable battery the only economical portable power source. In other applications a casual appraisal may be completely misleading. A primary battery may be less expensive for both the short and long term as well as being more convenient.

Consider the hypothetical case of two men who buy identical portable radios, operated by four penlite cells. Mr A is a machinist working in a noisy shop. He operates his radio ten hours a day at high volume (45 ma. battery drain) so it can be heard above the ambient noise. Mr B uses his radio an hour a day at low volume (15 ma. battery drain) in a quiet home.

The radios can operate on any of the several types of primary batteries (assume No. 1015 radio grade carbon-zinc cells at one dollar per set of four) or nickel-cadmium cells can be used (No. N46 at 11 dollars per set of four plus approximately seven dollars for a charger).

COMPARATIVE VALUES

Mr A can buy nickel-cadmium cells and a charger, recharge them every night and recover his investment, (compared to primary battery operation) in from two and a half to three months. A good investment. On the same basis Mr B would have to remember to charge his batteries once a month and would require six years to recover his investment—and by that time he might well need new nickel-cadmium batteries because they do not last forever. Obviously a poor investment. Sealed nickel-cadmium batteries are a fine product but they should be used only where primary batteries are uneconomical or impractical.

For use in electronic equipment, any rechargable battery should be hermetically sealed so that it is not necessary to add water and so that gassing on overcharge cannot carry corrosive vapor into the instrument. Also, the battery should be undamaged by long periods of storage, charged or discharged, and should have a low self-discharge rate. Sealed nickel-cadmium batteries meet these requirements best.

The nickel-cadmium battery is a remarkable device and more than 50 years of successful use have proved this

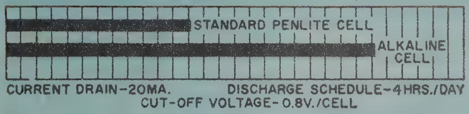
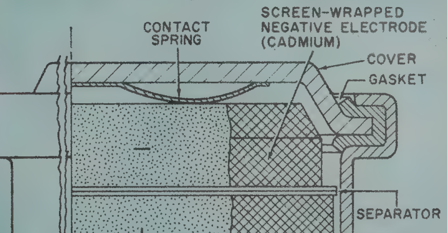


Fig. 2. The type E91 alkaline cell provides twice the service life obtainable from the standard penlite type cell.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−
SEPARATOR
+
CAN
EXPANDED METAL SPACER
SCREEN-WRAPPED POSITIVE ELECTRODE (NICKEL HYDROXIDE)

Fig. 3. Illustration shows a cut-away view of a typical sealed nickel-cadmium button cell described in the text. Such cells are used for hearing aids and similar miniature equipment.

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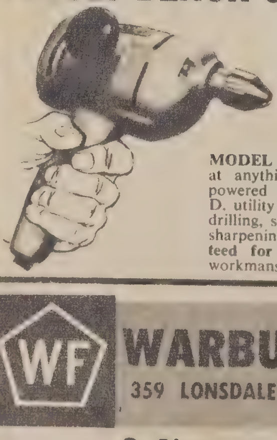

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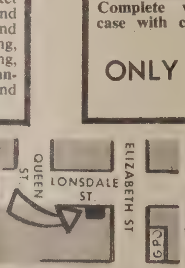

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point. Nickel-cadmium batteries may be recharged many times, have a relatively constant potential during discharge, and have excellent charge-retention properties. They will stand more abuse than any other cell, have good low-temperature performance chacteristics, and are competitive with other systems in terms of cost-per-hour use. They are true storage batteries using one of the very best electrochemical systems.

The nickel-cadmium cell has been used in Europe for many years in its original form as an unsealed cell, for automobile and truck starting and for fixed installations. Recent technological advances have made possible the extension of the nickel-cadmium system to small, hermetically sealed batteries — rechargeable batteries that are free from the usual routine maintenance, such as the addition of water. These developments have brought the economic advantages of rechargeability to small batteries.

SEALING THE CELL

A conventional vented-type nickel-cadmium battery will liberate oxygen and hydrogen plus entrapped electrolyte (potassium hydroxide) fumes through a valve. In order to hermetically seal a nickel-cadmium cell, it is necessary to develop means of using up this gas inside the cell. This is accomplished as follows.

1. The battery is constructed with excess ampere-hour capacity in the cadmium electrode.
2. Starting with both electrodes in the fully discharged state, charging the battery causes the positive (nickel) elecrode to reach full charge first and it starts oxygen generation. Since the negative (cadmium) electrode has not yet reached full charge it cannot cause hydrogen to be generated.
3. The cell is designed so that the oxygen formed can reach the surface of the metallic cadmium electrode where it reacts, forming electrochemical equivalents of cadmium oxide.
4. Thus, in overcharge, the cadmium electrode is oxidised at a rate just sufficient to offset input energy, keeping the cell in equilibrium at full charge.

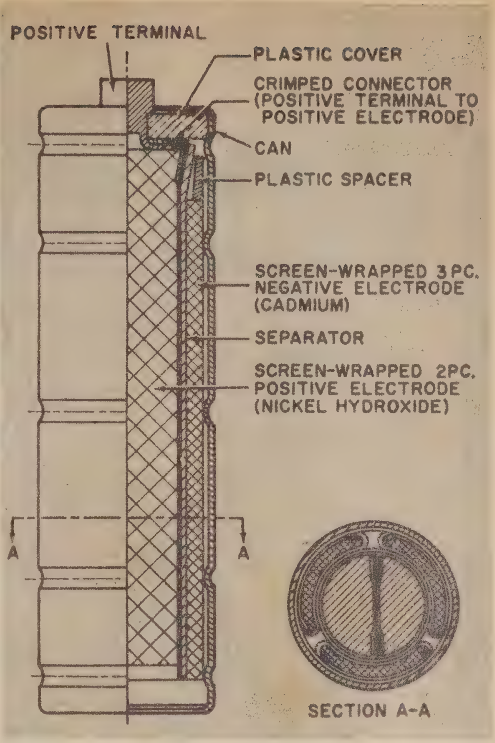
This process can continue for long periods. The level of oxygen pressure thus established in the cell is determined by the charge rate used.

Sealed nickel-cadmium cells are available in a variety of sizes and capacities. See Figs. 3 and 4. These include: button cells (50-500 ma.-hour capacity), cylindrical cells 450-2000 ma.-hour capacity), and rectangular cells (2-23 ampere-hour capacity).

The capacity of most nickel-cadmium cells is specified at the 10-hour rate (current drain required to discharge the cell in 10 hours). When they are used at higher discharge rates, the capacity is reduced.

Nickel-cadmium cells have the desirable flat discharge (constant-voltage) characteristic. As shown in Fig. 5, note that the average voltage is about 1.2 volt per cell. The initial voltage shown on the curves is designated as the voltage under load after 10 per cent of the ampere-hour capacity has been removed from a fully charged cell.

Any rechargeable battery will lose charge when stored. Nickel-cadmium batteries have a lower self-discharge rate than any other present secondary battery system. More important, the batteries are not harmed even if not used for long periods of time.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A
A
SECTION A-A

Fig. 4. Cut-away view of cylindrical nickel-cadmium cell.

Sealed nickel-cadmium cells experience a relatively small loss of capacity at operating temperatures, ranging from — 20 to +45 degrees C. Within this range, stable discharge voltage is maintained.

With most nickel-cadmium cells, the 10-hour rate should not be exceeded in constant-current charging. Fourteen hours charging at this rate will fully charge the cell. Constant-voltage charging, which is also acceptable results in a higher initial charging rate. At the start of charge the current may greatly exceed the 10-hour rate, but the charging circuit must be designed so that 10-hour current (or less) flows toward the end of charge.

The battery can be trickle-charged or floated. For maximum performance in situations of continuous overcharge, with occasional interruptions, the current should not exceed the 30-hour rate.

These cells also stand extended overcharge at rates considerably higher than those recommended for floating. Although charging at the maximum rate (10 hours) is normally expected to be completed in 14 hours, cells will not be damaged by occasional charging at this rate even for several weeks. Continuous overcharging at higher-than-necessary rates accelerates general degradation of the cell

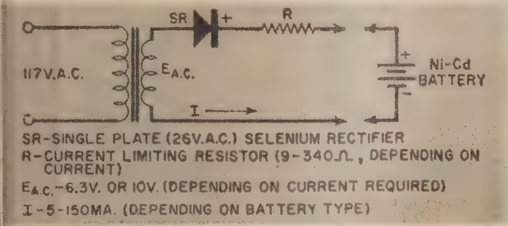
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Fig. 6. Circuit diagram of simple nickel-cadmium battery charger. More elaborate, constant voltage systems, allow shorter charging times.

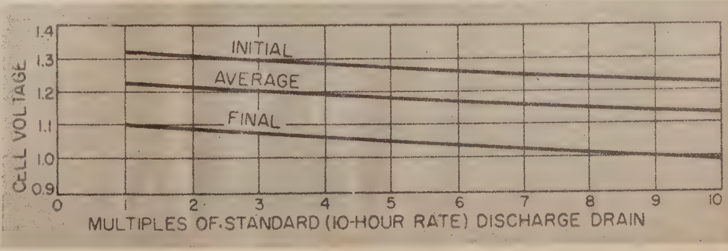

Fig. 5. Typical discharge voltages at various drains for sealed nickel-cadmium cells.

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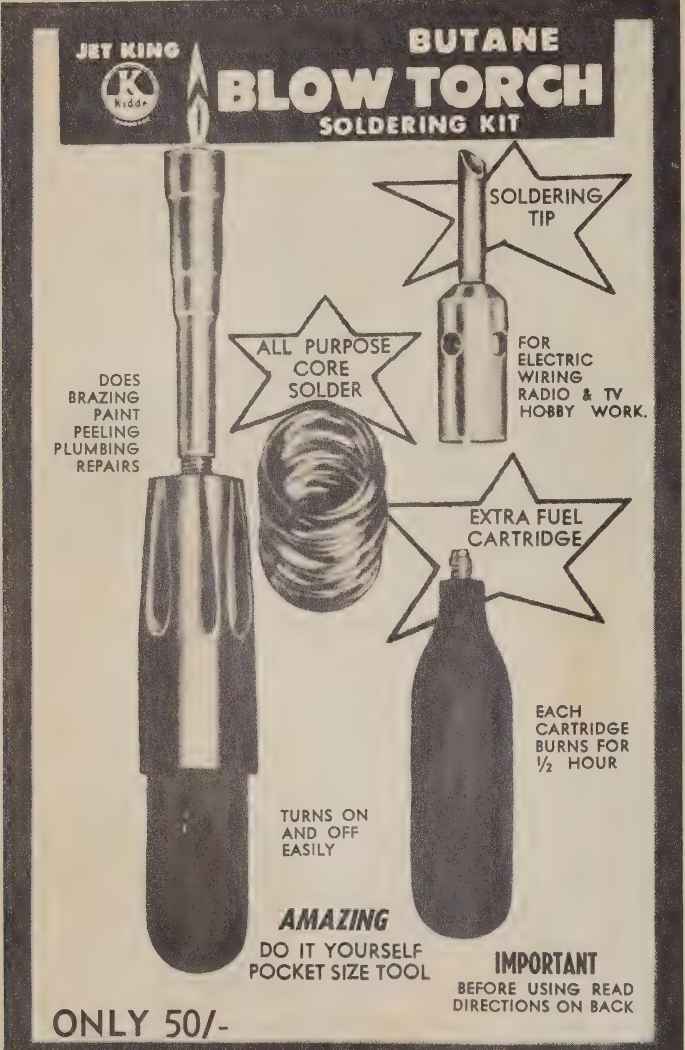
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BATTERIES

(Continued from Page 79)

but complete or sudden destruction will not result unless the 10-hour rate is exceeded.

A typical, yet simple charging circuit is shown in Fig. 6. Values of charging current for button and cylindrical cells range from 5 to 150 ma., depending on cell size, for a 14-hour charge.

When used in an appropriate application where true advantage can be taken of their simplicity and rechargeability, sealed nickel-cadmium batteries can make possible new battery-operated devices which would otherwise be completely uneconomical.

In conclusion, we may sum up the present battery market situation. Is the present multiplicity of batteries worthwhile? Has there been any real progress? The answer is an unqualified "yes." New battery systems supplement existing batteries. They improve the operation of many present devices, make possible new uses, and offer the consumer new choices so that he can obtain the best battery buy for his particular device and operating requirements.

Battery and portable-power research and development continue unabated. Future years will bring still better primary and rechargeable batteries and probably fuel cells and thermo-electric generators as well. Thus more new devices will be able to operate electrically without being tied to a power line.

SERVICEMAN WHO TELLS

(Continued from Page 75)

he wasn't even scratched. Nor was anyone else apparently, though it took some time to convince Pongo that he was only frightened.

In fact, this was little short of a miracle. As my colleague put it, "There was glass everywhere, none of it larger than about three inches square, and most of it having wicked razor-sharp edges or spikes. It was in my hair, my pockets, and my trouser cuffs. It was in every corner of the room, and we even found some in the kitchen sink.

"And there was more to it than the glass. Shreds of aluminising screen hung from me like tinsel on a Christmas tree, while there was plenty of other rubbish of the type normally found in a broken valve.

"And the smell! This was like a broken valve, too, only a heck of a lot stronger, and almost overpowering.

"I can tell you, cleaning everything up was a major undertaking."

I'm afraid I laughed when he told me all this, and he had to admit that it sounded funny in retrospect. But, as he said, "It wasn't funny at the time, mate. It wasn't funny at all."

And, of course, he is quite right. Someone could have been seriously injured, and it was only by sheer good fortune that they weren't. It emphasises most forcibly how careful one needs to be when handling these things, not only in the actual handling, but in taking suitable precautions beforehand.

For example, there is no reason for other people to be present and they are only running an unnecessary risk. They should be advised, politely but firmly, to retire to a safe place. In addition, they are less likely to create a hazard by distracting the serviceman's attention.

As to the serviceman himself, he will have to make his own decision as to what precautions he should take. Protective goggles have been advocated as the bare minimum, but even these are conspicuous by their absence as far as the average fellow is concerned.

Is it worth it? Should we risk an eye being gouged out by a sliver of flying glass, just because we are too lazy or too sensitive to don a pair of goggles?

I suggest we might do worse than think long and hard about that question.

NOTES ON THE 1961 TV RECEIVER

FROM correspondence on the 1961 TV Receiver, it would appear that some constructors have encountered trouble with instability in the scanning circuits, evidenced in most cases by a necessity to readjust the Hold Controls during the first half-hour of operation.

In all cases, this has been explained by the use of temperature sensitive high-K ceramic capacitors in the critical time-base circuits. Note therefore, that:

1. The .0068 mfd. capacitor in the vertical oscillator circuit should be of the paper or plastic type, preferably the latter.

2. The 470pF capacitor in the horizontal oscillator circuit should be of ceramic NPO, silvered mica or plastic type.

In addition to the foregoing:

3. Improved horizontal locking range may be obtained by increasing both 22-pF capacitors in the horizontal sync. amplifier to 33pF plastic or N.P.O. ceramic types.

4. Some receivers have experienced horizontal foldover effects on the left-hand side of the screen. This is due to insufficient capacitance to earth on the grid side of the 150K feedback resistor associated with the horizontal oscillator.

The adjustment can be made by reducing the width so as to expose each side of the raster. The picture should be centralised on the raster by removing the 15pF capacitor across the 150K resistor. If this is not sufficient, a capacitor of up to 30pF may be added from the junction of the 82pF and 150K resistor to earth.

If difficulty is experienced in seeing the raster edge in relation to the picture edge the brightness should be increased, thereby reducing artificially the size of the picture.

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(Post, 3/.)

CRYSTAL SETS

Readymade in miniature cabinet with knob, £1/19/6. Or with earpiece and plug, £2/9/11.
(Packing and post, 3/)

WOBBULATORS

New, reduced to 25/.
(Pack and post, 5/.)

MINIATURE ELECTRIC MOTORS

Suitable for driving model trains, cars, etc. Model 45, 8/6; 55, 10/6. (Post, 1/6.) Special Model No. 5 (3 to 10 volt), 39/6.
(Post, 2/6.)

POCKET COMPASS

Only ½in diameter Ideal for hiking, 2/6.
(Post and packing, 1)

MAGNIFYING GLASSES

1¾in diameter tortoiseshell rim. Folds into leather case, 7/6. Also 8x folding glass, suitable for jewellers, geologists, etc. 15/.
(Post, 2/.)

BREAST MICROPHONES

Voice-powered ex-R.A.A.F. breast microphones, 17/6 ea.
(Pack and post, 2/6.)

TELESCOPIC RIFLE SIGHT

Excellent gift for any shooting enthusiast. Supplies 4 magnifications through blued lenses and has windage and elevation adjustment hairsight. £6/15/-.
(Packing and registered post, 7/6.)

RECORDING TAPE

1,200ft of standard twin track tape on 7in plastic spools, 29/6.
(Post, packing, 3/6.)

BENDIX FREQUENCY METER

221 AK to 125 KC to 20,000 KC AC/DC. In attractive black crackle finish, £45.
(5/ delivery to rail.)

SUPER SANWA MULTIMETER

Suitable for checking household electrical appliances. Sensitivity 2,000 ohms per volt. Checks all voltages from 0 to 1,000 AC/DC. Also 0 to 500 microamps, 0 to 500 milliamps and plus and minus 20 decibels. £5/19/6.
(Reg. post, 8/6.)

SANWA MULTI-TESTER

Sensitivity 1,000 ohms per volt. Checks a voltages from 0 to 1,000 AC/DC
£3/19/6.
(Pack and post, 8/6.)

MAIL ORDERS

Carefully attended and expedited with the utmost speed.

ACE RADIO

PHONE
LA 3845

136 VICTORIA R'D. MARRICKVILLE, SYDNEY, N·S·W
AND 636 KING STREET, NEWTOWN — LA7008
EVENINGS and WEEKENDS: "KALUA," Hilma Street, Collaroy Plateau, XW5956
DULWICH HILL, UNDERCLIFFE, EARLWOOD BUS AT DOOR, STOP No. 42

AR8 Communications Receivers

12 valve. Converted to 240v A.C. Thoroughly Tested. Re-aligned. Latest Ovaltone Permag Speaker

£34/17/6

NEW VALVES

832A	19/6	VR75/30	15/
4D21	£4/17/6	RK48A	£3
12C8	12/6	954	7/6
VT501	12/6	VR105/30	15/
1C6	12/6	6AC7	5/
1J6	12/6	EL3NG	12/6
3B7	10/	2X2-879	5/
3D6	10/	6AJ5	9/6
304TH	£1/10/	VR150/30	15/
2050	£1	6AK5	17/6
6AM6	17/6	9006	5/
1K7	5/-	6AS7	12/6
1M5	5/	CK1013	15/
6J5	9/6	6SL7	15/
6J6	15/	EF39	12/6
6J7G	7/6	EK32	15/
6N7	10/	EBC33	12/6
KTW62/6U7	7/6	809	9/6
1D5	7/6	6AG5	9/6
6F6	12/6	7F7	12/6
EF37	12/6	EL91	10/
5U4G	12/6	EF73	10/
12K8	12/6	EF72	10/
1T4	10/	EC70	10/
1P5	7/6	2A3	10/
6AG7	15/	807	9/6
VT502	12/6	2C26	7/6
1L4	5/	RK34	7/6
6K6	7/6	1N5	7/6
AV11	3/9	1C7	2/6
6K7	5/	1Q5	5/
12SJ7	12/6	1M5	5/
12SL7	12/6	7C5	12/6
6SH7	7/6	7W7	7/6
47	12/6	12A6	5/-
843	£1/10/	6J8	17/6
1625	£1	6C8	7/6
1629	10/	VR65	5/-
1619	£1	12AT7	10/-
RK75	10/	808	17/6
723A	£3	12SK7	7/6
		726A	£2/10/-

100 NEW ASSORTED RESISTORS

Mainly I.R.C. ½-1-2-5 watt. 40 wanted values, 15/. Post 2/6.

100 NEW ASSORTED CONDENSERS

Paper, mica, ceramic, electro. 25 values. 15/. Post 3/6.

NEW C.R.O. TUBES

3API-906	£1/7/6
5BPI	£1/17/6
CV112	10/
VCR138	17/6
VCR97	10/-
5FP7	17/6
CV322	7/6
VCR511B	£1/7/6

NEW POWER TRANSFORMERS

240v A.C. 50 cycle primaries. Standard 6.3 filaments.

300 x 300v 40mA	19/6
1960 5" CRO	£5/10/
1960 3" CRO	£3/15/
325 x 325v 150mA	£3/17/6
250 x 250v 180mA	£3/17/6
295 x 295 300mA TV	£6/15/
1200 x 1200v, 500mA	£10/10/
550 x 550 250mA	£3/15/
800v and 270v. 300 mA. ea.	£7/10/
10v 5 amp	£1/10/
240v-110v. 1.3 Kv. Auto	£10/10/
150 x 150V 30mA	£1 5 0
225 x 225V 40mA	£1 7 6
124V Doubler 300mA	£2 10 0
130V Doubler 400mA	£2 15 0

Vibrator Power Transformers

6V 300V 125mA	£3 17 6
12V 325V 125mA	£3 17 6

Inverter Transformers

6V 240V 40 Watt	£3 7 6
12V 240V 60 Watt	£3 7 6
32V 240V 60 Watt	£3 7 6
12V 240V 100 Watt	£4 5 0
32V 240V 100 Watt	£4 5 0

RELAYS

6V, 3-pole Miniature	15/
1700 SPDT	7/6
1300 SPDT	7/6
500 x 500 SPDT	7/6
12 volts DPDT, 5 amp	£1
12 volts DPDT	12/6
100pf TX var. condensers	10/
100 to 500pf 3000v. var.	10/
500 to 2500pf 750v. var.	10/
Hi-speed Polarised relay	£2/10/
400 ohm	12/6
6V Type 3000 DP, DT	7/6

Hi-lo Phono Transformers	4/6
Hi-voltage, Lead-thru Insulators each; 15/ doz.	1/6
Multi-strand 4-core Cable, yard	1/
60pf with Vernier	£1/1/
30 pf	10/
Throat mikes, new	3/6

OIL FILLED CONDENSERS

.5mfd 600V	3/6
2mfd 600V	6/6
1mfd 600V	6/6
4mfd 600V	6/6
4mfd 2.5K	£1/10/
1mfd. 3,000V.	17/6
.5mfd 5K .1 5K, .1 3K AC .25 4K .5 2½K	15/ ea.

NEW ELECTRIC SOLDERING IRONS

6V. 10 Watt.

12/6

12V. 10 Watt.

15/-

Postage 2/6.

GENEMOTORS

Input	Output			
12v.	600v. 300mA	New	£5 10 0
24v.	250v. 100mA		£1 0 0
24v.	550v. 375mA		£2 0 0
24v.	250v. 60mA		£1 5 0
12v.	500v. 350mA		£8 10 0
12v.	1200v. 200mA		£6 10 0
24v.	250v. 100mA.	New	£2 0 0
12v.	235v. 50mA		£2 15 0
12v.	350v. 50mA		£2 15 0
24v.	540v. 200mA	New	£2 15 0
24v.	300v. 250mA	New	£2 15 0
12v.	275v. 110mA		£3 15 0
12v.	300v. 250mA	New	£2/15/

NEW HEADPHONES

Low Impedance.

American Lightweight	12/6
Australian DLR	12/6
USED	
Tested DLR or CLR	9/6
Dynamic	17/6
Single. New Earpieces	2/

Post 2/6 Pair.

H.M.V. OSCILLOSCOPE

3 INCH

240V A.C. Powered. Provides all required Radio and TV functions.

LESS VALVES . . . £12/10/-
NEW SET OF VALVES . . £5

Power supply only as used in above instrument. Will suit most C.R.O.S. 300V to amplifiers. 750. 1300. 1900. Tapped H.T. to display tube.

LESS VALVES £3/15/-
NEW VALVES . . . . £1 EXTRA.

WANTED

Communications Receivers. Test equipment, P.A. Gear. Large or Small surplus stock. Best prices. Call, write or phone any time.

ELECTRIC CLOCK MOVEMENTS

240v AC. Tested. Perfect order.

19/6

Post. 2/6.

New T. B. Transmitter Receivers

Small Battery Operated Pack Sets. 27 to 80 Megs. That operate on Citezens Band. Also 6 and 10 metres. 130 Channels. Complete with valves, Circuit and Conversion data for crystal control.

£14/17/6

NEW METERS

10mA centre zero, 3½in. scaled. 100-0-100mA. 300-0-300mA.

£1/10/-

10mA scaled 150-0-150V.

£1/10/-

1mA 4in square. Scaled volume units.

£1/17/6

5in lab. standard in cedar cases. 0 to 3 amp., 0-15 amp.

£3/15/-

0-10 amp, 0-500mA, 0-15 volt, 0-50 volt, 0-3,500 volt.

£3/-/-

ELECTRIC PUMPS

New 400 G.P.H. 24V Aircraft Pumps Will operate from 12V.

£4/12/6

NEW ROTARY CONVERTERS

160 watt. 50 Cycle.
24v to 32v input.
Output can be supplied for 50-110 or 240v as required.
Suit radiograms, TV, tape recorders, fluorescent lights.

£19/17/6

New 100 Watt Fully Filtered. Metered Unit as above. Ideal for Tape Recorders, Radiograms, etc. 240V A.C. 50 CYCLE **£16/17/6**

COMMUNICATIONS RECEIVERS

American, National, H.R.O. Air Tested, Perfect Order. 6 Coil Boxes to 30 Megs. Crystal Gate, S. Meter, 2 R.F., 2 I.F. 240V AC.

£75

AMR 101

A.W.A. Version of Above Set. Similar Circuit and Facilities to 25 Megs.

£65

MARCONI RECEIVERS

B 28.

6 Band, 40 K.C. to 32 Megs. A.C. Powered. 11 Valve. Variable Selectivity Band Spread.
New condition. Realigned. Perfect order.

£65

Also CR150

13 Valve, 5 band, 2 meg. to 60 meg. A.C. Powered.
Variable Selectivity Band Spread. New condition. Air tested. Perfect order.

£75

Type 31 Transceiver

F.M. Pack Set. 20 Valve. 24V Powered. 41 Channels. 40 to 48 Megs.

New Condition.

Complete with valves, crystals, circuit

£27/10/-

522 TRANSCEIVERS

Complete with Valves. Excellent Condition.

£8/17/6

522 Receivers. Complete with Valves **£5/17/6**
522 Transmitters. Complete with Valves **£4/17/6**

P.A. SPEAKERS

New Dynaphon P.A. Units. Double ended with short reflex horns.

£12/10/-

American R.C.A. 20 Watt P.A. Speakers. Used. Tested. Perfect order.

£10/10/-

CARBON MICROPHONES

Respirator Type	2/6
Mark 3 Handmikes	5/6
Mark 7 Dynamic	12/6
Sound Powered	12/6

Post 2/6 Each.

AIRCRAFT GENERATORS

28V. 100AMP. £12/17/6.
28V. 60AMP. £10/10/-.
12V 50 Amp **£5-15-0**

A C E

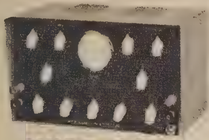
Amplification Communication Electronics

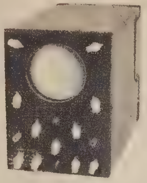
RADIO

PHONE
LA 3845

136 VICTORIA R'D. MARRICKVILLE, SYDNEY, N·S·W

636 KING STREET NEWTOWN-LA7008





WIDE BAND OSCILLOSCOPE

5 Meg. Bandwidth. Push-pull vertical and horizontal Amplifiers. 8 position, high sensitivity vertical Amplifier, Frequency Compensated on all positions. Calibrated .02 to 600 volt. Hard-time base, 20 cycles to 75K. Latest American R.C.A. circuitry. Complete with probe.

3-inch £49/17/6 5-inch £55/15/-

VACUUM TUBE VOLTMETER

6 voltage ranges, 3, 10, 30, 100, 300, 1,000 volts AC and DC. 5 ohms, ranges 1 ohm to 1,000 megs. Contact. Potential compensated. Accuracy 1%. Provision for probe.

£29/15/0

DUO-PHONE 10 x 10 STEREO AMPLIFIER

10 watts per channel.
Valves 4.6BQ5. 2.7199. 4.EF86.
High Quality Transformers.
Input for Stereo. Gram. Mike. Tape. Monaural. Radio.
3-Speaker Output.
Kit Set .. .. £49/10/-.
Wired and Tested £56/10/-.
Also with built-in DUAL WAVE TUNER. Including R.F. STAGE.

£66

NEW BATTERY CHARGERS

To charge 6V plus 12V plus trickle 2 to 12V.

3 AMP	5	15	0
4 AMP	6	15	0
6 AMP	10	15	0

Postage 7/6, 7/6, 12/6.

25 watt, 8 valve, P.A. 240 V.A.C. AMPLIFIER

Input for crystal mike. P.U. or radio with mixing facilities and tone control. High quality O.P. transformer for multi match O.P.

£23/17/6

Send for full details on Radiogram Chassis, TV and Amplifiers.

GUITAR AMPLIFIER

17 Watt 4 Input Channels. Base and Treble Boost.
2 Twin Cone Hi-Fi Speakers.

£36/17/6

MULLARD CORDLESS MANTEL RECEIVER

R.H.-T. Oct. issue.

This outstanding unit performs equally well in the home and garden, Beach, picnics, boat or car. Truly a universal set of excellent appearance and performance.

YOU CAN BUILD IT!

Complete kit of parts including Cabinet.

£22/17/6

Wired and Tested and Guaranteed.

£24/17/6

Postage, N.S.W. 10/-, interstate 15/-.

Playmaster Stereo AMPLIFIER No. 2

7 watts per channel. Bass and treble boost. Dual push-pull. Hi-quality Ferguson or A & R O.P. transformers with ultra linear connections.

£42/0/0

(Post 15/.)

Also in Kitset form, £37/10/.

Also as above, 4 watts per channel. Same cabinet and control features. Ferguson output transformers. Frequency response. 30 to 20,000 cycles.

£26/17/6

(Post 15/.)

SPECIAL ACCESSORIES OFFER WHEN ORDERED WITH ABOVE UNITS.

2 8 W.R. SPEAKERS AND 4-SPEED STEREO PLAYER.

£14/10/0

(Post 15/.)

TRANSISTOR TESTER

2-Meter Unit, A.C. Powered, gives direct reading of Beta and I.C.O. under actual operating conditions.

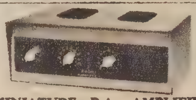
£12/17/6

Post 10/.

MILLIVOLTER

11 Ranges. 3 Millivolts to 300V. 2% accuracy.

£39/17/6



MINIATURE P.A. AMPLIFIER. 15 WATTS OUTPUT.

Multimatch. Ferguson O.P. transformer input for crystal mike and pick-up with electronic mixing. P.P. EL.84 output, £17/15/.
As above, Mullard 5/10. Hi-Fi circuit. Bass and treble boost, etc. £21/15/.
Post: N.S.W., 10/; Interstate, 15/.

AMPLIFIERS

Public Address Range
240v-AC

6 Valve, 10 watt,	£14/17/6
6 Valve, 25 watt,	£25/17/6
7 Valve, 20 watt,	£22/17/6
100-watt	£63
40 watt	£35/15/0
50 watt	£39/15/0

Battery Operation

6 valve 6v, 10 w £18/15/
7 valve, 12v. 12 watt, £19/15/
7 valve, 12v. 25 watt, £24/17/6

BATTERY-AC OPERATION

6 valve 6V plus 240V 10 watt, £20/15/
7 valve 12V plus 240V 12 watt £21/15/
7 valve 12V plus 240V 25 watt £29/7/6

TRANSISTOR POWER SUPPLIES

12V DC input, output 150V, 200V, 300V, 400V at 150mA. 80% efficiency. For use with mobile equipment, transmitters, P.A., etc. £18/10/. Post 7/6.

7 TRANSISTOR CAR RADIO

Amazing sensitivity. 2 microvolts. No noise. Brilliant tone. Using latest drift-type transistors. Complete with speaker, aerial, filter box, lead-in, etc. Fully tested and guaranteed.

£31/15/-

(Post 10/.)

State voltage, 6 or 12, earth polarity, speaker size and aerial required. Also available for special frequencies, Bushfire, Flying Doctor, small ships, Services, etc.

LEADER SIGNAL GENERATOR L.S.G. 10

240V A.C. Power.
6 Band. 1% Accuracy.
120 KC to 270 Megs.

£15/0/0

L.S.G. 11

As above. Range to 390 Meg.
Provision For Crystal.
An ideal TV Marker Generator.

£18/15/0

Post. N.S.W. 7/6; Interstate, 10/.

LEADER LSG.531

SWEEP & MARKER GENERATOR £72

Including Tax
240v. A.C. POWERED 2 to 270 Meg

K 20

K 20

MULTIMETER

20,000 O.P.V. sensitivity.
Ranges:
DC volts, 0, 10, 50, 250, 500, 1000.
AC volts, 0, 10, 50, 250, 500, 1000.
DC current 0.50uA, 0.25, 0.500mA.
Resistance, 0.50K, 0.05 meg, 0.5 meg.
D.B. minus 20 to plus 36.

£7/19/6

K50. 50,000 O.P.V.
Ideal TV Test Unit.
Current Range to 10 Amp.

£19/10/-

MODEL K.2

2000 O.P.V. Sensitivity:
Ranges as above except 50uA.

£5/12/6

Post, N.S.W., 3/6; Int., 5/6.

MODEL K.4

4000 O.P.V. Miniature.

£4/15/-

Post. 3/6.

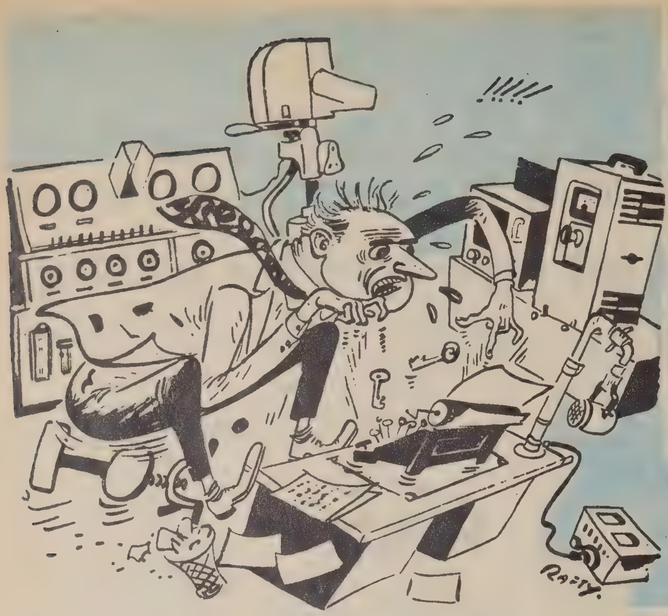
LATEST 4-SPEED PLAYERS

240 A.C. Monaural	£7	5	0
240 A.C. Stereo	£9	5	0
Battery Monaural	£9	5	0
Battery Stereo	£11	10	0

Post. N.S.W. 7/6; Interstate, 12/6.

New Transporta 7

With R.F. Stage. 1 Watt Audio.
Using drift type transistors.
Improved range and performance.
KITSET £25/17/6
WIRED and TESTED, £28/7/6.



Let's Buy An Argument

ABOUT ITEMS OF INTEREST

This is one of those months when I seem to have collected correspondence on a variety of unrelated subjects. It is quite impractical, therefore to start with a big flourish—so what does one do? Well, one simply submits to writing an unenterprising introduction like the foregoing!

By Neville Williams

LETTER number one comes from a reader in Blackburn, Victoria, over the initials A.J.C.H. (With that many initials, it would be difficult to remain anonymous.) He says:

"I heartily agree with your comments in 'Let's Buy An Argument' (August, 1961) regarding interruption of television programs for advertising and I shall feel deeply for anyone who watches these programs.

"However, I wondered how sincere your comments were when, having read page 73, I was obliged to turn to page 75 and then search page 79 for the conclusion of the article.

"How about beginning at home? I am sure there are many other readers of your magazine who would prefer the articles to be arranged so that they can be removed whole for reference.

"Good luck with your F.M. campaign.

"Yours sincerely, A.J.C.H."

Well, I must thank our correspondent for his letter but he makes me feel rather like the unfortunate husband whose wife anticipates his reaction to a given proposition, then proceeds to scold him roundly for saying what she knows he would have said, had he been given the chance!

The point was that I had very little to say, personally, about advertising on television programs. Rather, having mentioned the reaction of New Zealand readers to the then-new commercial television, I made a purely objective remark about the reaction of Australian viewers to the same sort of thing. I then pointed out the rather crazy proposal in England to split feature films with complete program segments—not just advertising.

Finally—and this was the only really personal comment — I counselled discretion in the content and placement of the advertisements, assuming these to be necessary for financial reasons.

In view of this very minor personal contribution, I rather wonder what our correspondent finds with which he can so "heartily agree." Nor does there seem to be much with which I can be so blatantly inconsistent.

GOVERNMENT POLICY

The fact is that the Australian Government has long supported the idea of side-by-side existence of "National" and commercial radio and television. Though the system has had many critics, it has also worked out pretty well, in the overall view, and has been a factor in influencing other countries to follow suit.

Obviously enough, if we are going to accept commercial radio and television as a means of providing us with a wider choice of programs, then we must be willing to accept the means by which commercial stations exist, namely by the presentation of advertisements.

Nor is it much good saying, "We want extra channels, we will tolerate commercial radio and television but we won't tolerate more advertisements than suits our personal whim." It smacks too much of the familiar old proposition about partaking of one's cake, yet retaining material possession thereof.

In the cold, hard world of competition for-viewers' attention, there is a very delicate balance between what can be spent to present what people want, so that they will support you sufficiently to spend enough to buy what people want, so that they will support you . . . etc.

It is precisely why program managers go gradually grey trying to anticipate audience reactions to shows, new and not so new.

And it's much the same with newspapers and magazines, of which "Radio, Television and Hobbies" is just one. Advertising provides an essential part of the income necessary to balance the books. Cut out the advertising and it might be necessary to double the price for a journal containing the same amount of editorial matter, compressed into half the present number of pages.

Not a very saleable product, I fear.

And there's another thing (which I couldn't possibly admit to our advertising manager):

Though it is sometimes assumed that readers object to advertising, the reverse is more likely to be true. Well-displayed advertising contributes a variety and a liveness to a publication, which is best appreciated by looking at certain overseas publications, from which advertising has been purged.

And, if it's true in general, it's far more so in a technical journal like "Radio, Television and Hobbies," where the advertising, by and large, is directly related to the subject of prime interest —electronics.

Well, then, reduce advertising content? Group it in blocks? Speaking selfishly, as an Editor, I might say one thing. Speaking practically, as one of a team charged with maintaining the economy as well as the production of the journal, I might have to say another.

In point of fact, laying out the magazine so that editorial and advertising material, colour pages, spreads, etc., will combine with some semblance of order is one of the major tasks we face each month. And, of course, you just can't end up with a column over or a column under; the contents have to be made exactly to fill certain whole numbers of pages which the presses can print.

If this means jumping over advertisements here and there, the situation isn't quite a parallel to television advertising. On the printed page, you can skip an advert, at will, inside a second. With television, you have to sit them out, whether you like it or not!

THE U.K. SCENE

Just before I close the file on advertising (let's hope for some considerable time) I was intrigued by a couple of paragraphs in a recent issue of the "Radio and TV Digest" newsletter recently to hand from England. Both have to do with the subject we have been discussing, that of advertising. The first reads thus:

"Children at the Margaret Tabor Secondary School at Braintree, Essex, are being taught to discriminate between good and bad advertising. Mr Donald Leech the science master, has started a special class because he feels children are far too susceptible to the wiles of advertisers.

"He believes that unless children are taught to treat their claims with a certain amount of healthy criticism, they will grow up to be morons accepting everything they are told. Instead of a blackboard, Mr Leech uses comics, "pop" records and newspaper advertisements. He plays tape recordings of television commercials and the children are asked to spot any gimmicks."

The second had to do with a protest which a local Fire Chief and an Alderman lodged against the use of a nursery rhyme in a television commercial. They did it on the grounds of safety.

It seems that a particular advertisement issued by the National Home Safety Committee warned children against the danger of reaching up to pans on a hot stove, lest they spill the contents over themselves, with tragic results.

Very good.

The trouble was that the adjacent advertising spot, for reasons of its own, featured the nursery rhyme "Polly put the kettle on!"

UNSHIELDED COILS

Last month, I had to answer a reader who had taken us to task for using an I.F. amplifier strip in a television receiver having unshielded coils. To him, they could only mean unsatisfactory operation.

In reply, I pointed out that the same I.F. strip had been current for several years, had proved perfectly satisfactory in practice and was not unlike a variety of similar strips used by major manufacturers throughout the country.

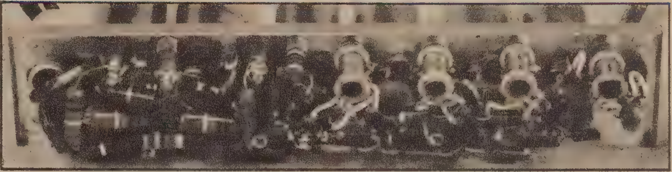
By chance, however, a member of our staff came across another pretty convincing argument, pictured herewith.

It is an I.F. strip from a type 181 airborne Radar equipment, used up till a couple of years ago in Sabre jet fighters. Manufactured by a number of big concerns in the U.S., the I.F. strip in question is a 4-stage 30Mc strip, without artificial damping on the tuned circuits and normally aligned to a bandwidth of 4Mc.

It can, however, be peak aligned to give higher gain and a bandwidth of 1Mc.—still without instability. And the interesting thing, of course, is that it also uses unshielded interstage coupling coils.

I think the point has been made.

EXAMPLE OF UNSHIELDED COILS



Underside of the 30Mc. IF strip from the airborne radar equipment, used until recently in the Sabre jet fighters. Note the unshielded interstage coupling coils, and their relative proximity.

VIDEO COUPLING

From a reader in Melbourne comes a rather lengthy letter commenting on several things which have been mentioned of late in these columns. He says:

"I noticed the American article on automatic tuning via the sound ratio detector mentioned on page 72 of your October issue. What really amazed me was that no one challenged the article in subsequent issues—or wasn't the Editor of the said journal admitting his mistake?'

I don't know, but I, too, looked in vain for subsequent comment on the subject.

Our correspondent, a real stickler for "visual hi-fi" on television then goes on to what is one of his pet subjects. He says: ,

"I find the literature on DC restoration one of the foggiest in television. While everyone is willing to talk and give circuits for grid-coupled cathode-ray tubes, they all dodge the issue when it comes to cathode coupling.

"I know only two circuits that will really work and one is your triode DC amplifier system, as attacked by the correspondent last month. He should do a little more reading (and experimenting) before jumping into print.

"Most of the published circuits just don't restore DC, because of the degeneration produced by the cathode resistor of the cathode-ray tube. With AC coupling the cathode-ray tube operates under 'class A' conditions and the average current in the cathode resistor is constant. As soon as you add DC restoration the tube operates 'B class' and the current varies with the DC component. This produces a voltage between cathode and ground which very effectively opposes the action of the DC restorer.

"The solution is an amplified DC voltage which can be adjusted to beat the degeneration. With this same adjustment, screen degeneration in the video amplifier can also be beaten. Your circuit will, therefore, produce 100 per cent restoration.

"The system that R.T. proposes is not DC restoration but partial DC couling, with all its characteristic defects. Furthermore, his brightness control will not be very

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TELECOMPONENTS TYPE 5506

MULLARD 5 TRANSISTOR CORDLESS MANTEL 604R--Radio, TV & Hobbies, Oct. 1961

Type No.	Details	Full Price Delivered
7105	Aerial Loopstick 8 x 3/8" rod	18 0
7309	Osc., Coil, Ducon pot	9 0
9107	455 Kc. IF T3 Ducon pot	8 6
9108	455 Kc. IF T3A Ducon pot	8 6
9109	455 Kc. IF T4 Ducon pot	8 6
5203	Driver Transformer	21 10
4306	Output Transformer	21 10
COMPLETE COIL AND TRANSFORMER KIT,		**£3 16 0**

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Type No.		
9200	Miniature I.F. Transformers 455 Kc. in ¾" square based can Universal Type — suits all receivers—delivered	7 6
	6 inch Speakers 3 Ohm Voice Coil — delivered	28 6

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Full Price for all Coils and Transformers (delivered)

Broadcast Only ___ £5/0/0
3 Band Set ______ £7/0/0

Kit contains all Coils, Ferrite Rod or Aerial Coil, I.F.'s and Audio Transformers. (When ordering, please specify Aerial Coil or Ferrite Loopstick). All components are fully tested to specifications, exactly as supplied for the original receiver.

Alternatively, items may be purchased singly

TYPE No.		s	d
718	Tuned Ferrite Aerial Rod and Coil (optional)	17	6
719	High Gain Aerial Coil	17	6
739	Oscillator Coil	9	10
729	R/F Coil	10	8
919	455 Kc. I.F. Transformer, double tuned, each	16	9
524B	Driver Transformer	17	6
4302	Output Transformer for 3 Ohm Voice Coil	17	6

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S.W. Aerial Coil 2-6 mc No. 7400	10	8
S.W. R.F. Coil 6-18 mc No. 7520	10	8
S.W. R.F. Coil 2-6 mc No. 7502	10	8
S.W. Oscillator Coil 6-18 mc No. 7621	10	8
S.W. Oscillator Coil 2-6 mc No. 7602	10	8

(Please state frequency range when ordering.)

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Type TVP128. Delivered, only	£3 5	0
Filter chokes, 10 Henry 3 1-8" Centres, 2 hole mounting, for use with TVP128 Transformer. Cap input filter. Type TVP127. Full Price	12	6
Filter chokes for TV and Amplifiers, 300 mA 1H. Type 817	8	6
1st Video I.F. with 30.5 mc/s trap, no can Type 943	6	8
2nd and 3rd Video I.F., no can Type 941	6	8
Video Detector; T102 1 3-8" sq. can	13	1
Sound take off Transformer 5.5 Mc/s T206 in 7-8" sq. can	6	10
Ratio Detector; T102; 1 3-8" sq. can. Universal Type	16	4
Video Series Choke, L204, 36uH, to improve picture quality	2	0
Peaking Coil 300 microH. L208	2	0
Peaking Col 400 microH. L903	2	0
Spook Suppressor for damper tube L403, 1.5uH on resistor blank	2	0

Price includes Packaging, Postage and Tax.

COMPACT 6 BAND SERVICE OSC.

September Issue, 1960.

Set of 6 Coils Bands A to F	72	0
Line Filter Chokes, Each	8	6
Audio Freq. Osc. Transformer	17	6
Power Transformer	37	6

Including Tax and Postage.

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effective and will need to be moved to the grid circuit of the cathode-ray tube.

"A system that will work is to place a diode across the coupling capacitor. The diode clamps the cathode of the CRT to the peaks of the synch. pulse and maintains a constant black level, regardless of the D.C. component, the system is actually better than DC coupling because it corrects for screen degeneration, which DC coupling does not."

Thank you R.O. for a nice piece of support on that subject. If you should feel like a change from your present occupation, we might be able to find for you a niche on our staff—writing "Let's Buy An Argument!"

After further comment about our continued use of simple, rather than keyed AGC, R.O. raises a question which I cannot remember having discussed in these columns. I quote:

"One other subject I would like to mention is that of corrector magnets. I am using a long-neck-21-inch tube and an MSP yoke. This produces a noticeably pincushion raster which I have corrected by the use of small external permanent magnets.

"Most of your designs have used similar yokes but I have seen no mention of corrector magnets. Am I unfortunate in the amount of raster distortion or do people just put up with it?

"I am aware that many commercial sets use corrector magnets but I have never seen advertisements for them in your magazine. Are they available commercially?"

RARELY MENTIONED

In reply, I must agree that the subject is one which is rarely mentioned. (Perhaps I should also add, for those who are not familiar with the term, that "pincushion" effect is the tendency for a picture to develop long corners and to bow inwards at the ends, top and bottom, in the general shape of a pin-cushion.)

Broadly, the difficulty of obtaining a truly rectangular picture, without magnetic correction increases with the deflection angle.

Very few 70-degree receivers used corrector magnets, the picture generally being reckoned as good enough for all practical purposes, assuming that its limits were going to be hidden by the frontal mask plate. Yokes did vary, however, even in the same brand, some giving cause for complaint.

Much the same remarks apply for 90-degree receivers. Our correspondent may be more than normally critical or he may have a yoke exhibiting more than its share of the effect. Possibly both remarks apply.

The latest 110-degree yokes normally have corrector magnets built in and pre-adjusted as part of the assembly. You wouldn't know they were there if you didn't go looking for them.

I understand that these magnets have very definite properties which suit them for the purpose. Built into the yoke, they must resist demagnetisation by the strong fields in which they operate.

I do not recollect ever having seen corrector magnets advertised for sale, though I imagine they would be obtainable as replacement parts from Service Departments, etc.

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NEW INSTRUMENT CASES AND PANELS for Radio & Hobbies

ELECTRONIC STETHESCOPE
June, 1961.

Case & Printed Panel (Black & Silver)	£2	5	0
Case & Engraved Panel (Multi Colour)	3	15	6

Plus 12½ per cent Sales Tax.

MILLIVOLTMETER
Oct., 1961.

Case Chassis	2	12	6
Printed Panel		19	6
Engrave Panel (Multi Colour)	2	10	0

Plus 12½ per cent Sales Tax.

TUNING FORK FREQUENCY STANDARD
(Audio Frequency Standard 500 CPS.) Oct., 1961.

Case Chassis	2	16	6
Printed Panel	1	3	0
Engrave Panel (Multi Colour)	2	13	6

(Both Panels have Metal Fret).
Plus 12½ per cent Sales Tax.

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April, 1961

Chassis & Printed Panel (Brown & Silver)	5	5	6
Chassis & Engrave Panel (Red or Brown letter)	6	6	0

Plus 25 per cent Sales Tax.

100 WATT P.A. July 1960.

Chassis Cover & Base Plate	5	11	0
Engrave Panel (Multi Colour)	2	10	0

Plus 25 per cent Sales Tax.

VERSATILE 2 x 10W STEREO AMP. May, 1961.

Chassis & Case	6	5	0
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Tuner Unit Wide Band Metalwork	3	4	9
2/2 Amplifier Chassis	2	0	0
Panel Printed		19	6
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5/10 Amp. Chassis	2	5	0

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MC4	7 x 4 x 4 ..		17	6
MC5A	With louvred ends 9 x 6 7/8 x 5½	1	5	0
MC5	Al. Chassis ..		16	6
MC6	6 x 6 x 6	1	3	0
MC6L	With louvre ends 6 x 6 x 6	1	5	0
MC6	Al. chassis ..		16	6
MC62	6 x 6 x 2½ ..	1	0	0
MC67	12 x 7 x 6 ..	1	12	6
MC67	Al. chassis ..	1	3	6
MC7	10 x 8 x 7 ..	1	12	6
MC79	15 x 9 x 7 ..	2	12	6
MC81	10 x 10 x 8 ..	1	15	0
MC811	12 x 11 x 8 ..	2	2	6
MC82A	With louvred ends 13 x 8 x 6 7/8	2	2	6
MC82A	Al. chassis ..	1	4	6
MC87A	With louvre ends 15 x 10 x 8	2	12	6
MC87A	Al. chassis ..	1	7	6

Open at largest side.

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S.F.8	13 x 8 x 8	2	2	6
S.F.9	15 x 9 x 9	2	10	0
S.F.10	18 x 10 x 10 ..	2	12	6

With only slope panel removable

S.F.7A	7½ x 7½ x 7 ..	1	5	0
S.F.79	9 x 6½ x 7½ ...	1	10	0

All cases plus 12½ per cent tax.

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TRADE REVIEWS AND RELEASES

A COMPACT V-T MILLIVOLTMETER

Jacoby Mitchell and Co., distributors in Australia of a large range of test equipment have announced the release of a new vacuum-tube millivoltmeter manufactured in Japan by the Kikusui Denpa Co. Ltd., The unit features high sensitivity (15 millivolts full-scale) with a compact and attractively styled case.

THE clearly calibrated meter scale is coloured an unusual lemon shade, which enhances its readability under difficult lighting conditions. Ten positions are provided on the range switch from the aforementioned 15mV to a most useful maximum of 500 volts RMS, with the ratio between steps being 10dB or approximately 3/1 in voltage ratio.

Illumination (much in the style of a modern TV set) is provided through the dark red plastic range dial so that only the range in use is lit at any one time. Different coloured lettering is used between the mV and volts ranges to distinguish between them.

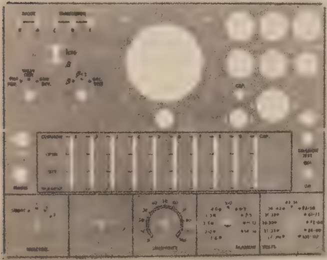
The input impedance is given as one megohm in parallel with a capacitance of 25pF, plus or minus 2pF . Frequency response is stated to be plus or minus 5 per cent of full scale between 10 cycles and 500 Kc and plus or minus 10 per cent of full scale between 7 cycles and 700Kc. Individual calibration charts to this effect are provided with each instrument. Indication by noise with the input terminal opened is 1 per cent or less of full scale, which amounts to an amplifier noise level of -65dB. Amplifier distortion at full scale reading is given as 3 per cent while the S/N ratio at full scale is -35dB.

Calibration accuracy and frequency response lived up to the manufacturer's specifications and no adjustment of the side-mounted pre-set zero controls was necessary during our period of testing.

Trade price of the instrument is £47/10 plus sales tax and further enquiries should be directed to the agents, Jacoby Mitchell and Co., of 469 Kent Street, Sydney. (K.W.J.)

PANEL FOR YOUR VALVE TESTER

Recently released by Heating Systems Pty. Ltd. is this etched panel designed to suit the Radio Television and Hobbies Valve and Transistor Tester featured in the December, 1960, and January, 1961, issues of the magazine.



THE finish is in nickel and the marking is done in six distinctive colours to aid identification of the various functions. The dimensions of the panel were supplied by us and all holes have been pre-punched, allowing for immediate assembly of the unit.

It should be noted that Heating Systems Pty. Ltd. are successors to R. H. Oxford and Son Pty. Ltd., long known for their manufacture of cases and panels to suit R. TV and H. equipment. Supplies should be available through normal trade sources, but further enquiries may be directed to the manufacturers at 97 Marriott Street, Redfern.

ISOTOPE HANDLING EQUIPMENT—AWA

Amalgamated Wireless (Australasia) Limited have announced the release of a new system for the storing and manipulation of Radioactive Isotopes.

BECAUSE radioactive sources in the form of isotopes are now readily available at low cost their use has become widespread. Many medical workers are concerned with the daily use of isotopes and it is important that equipment for their storage should provide a high degree of protection against radiation. It is also desirable that such equipment be functional and efficient.

It is, therefore, interesting to hear that a range of equipment designed especially for the storing and handling of radioactive sources is available in Australia. Known as "PANTA-SAFES," these units are made in England by Test Equipment (Models) Ltd., a company which is widely known for its deep-ray therapy equipment.

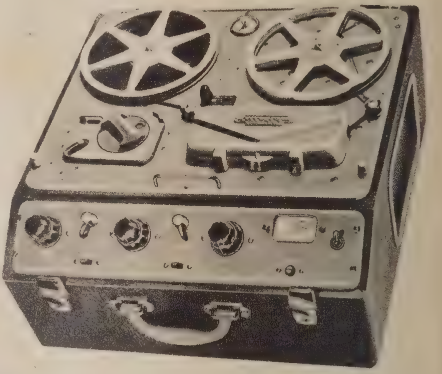
Designed after a close study of all the problems involved, the units possess many features contributing to enhanced safety and ease of operation. They are made to conform to the most stringent safety regulations and, with the aid of the available accessories, provide a convenient means of handling radioactive substances easily, with complete freedom from the possibility of accidental radiation burns.

The range of accessories available includes tongs, loading jigs, needle threaders, bottle openers, automatic pipette, etc.

Further inquiries should be directed to the sales engineering branch of Amalgamated Wireless (Australasia) Limited.

NEW FERROGRAPH TAPE RECORDER

Representing a significant advance in both facilities and performance, the new models 422 and 424 are the latest development in the well-known "Ferrograph" range of tape recorders.



DESIGNED to provide effective stereo reproduction, the units have two complete recording amplifiers and two playback pre-amplifiers built in. The playback pre-amplifiers are connected to separate playback heads and output may be taken either from the input signal or the playback heads. Output from the playback section is 1.5 volts RMS. sufficient to drive an existing high quality stereo system. This arrangement confers the maximum degree of flexibility and the recorder is therefore able to perform the most varied tasks.

The wide range of facilities offered is the result of a close study of user requirements, including the evidence of a very comprehensive field survey in which many thousands of users co-operated. Briefly, these facilities are as follows:

(1) It will record and playback monaurally on either track independently in the forward direction, and with continuous monitoring.

(2) It will record and playback stereophonically with continuous monitoring on both channels.

(3) It is possible to playback on one track while recording on the other.

(4) A signal recorded on one track can be recorded on the other.

(5) During the transfer of a signal from one track to another, additional signals can be superimposed through the simple mixing facilities provided.

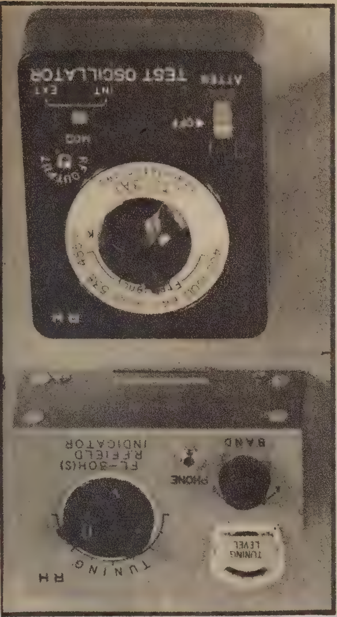
(6) The recorded signal can be instantaneously compared with the input signal during recording by means of a comparison switch on the panel.

(7) By making use of the delay between the recording and playback heads, echo effects can be introduced.

While we have not had the opportunity to actually test the unit, manufacturer's literature (usually most reliable with this firm) indicates the specifications and performance to be as follows: Frequency response, 3¾ ins/sec. 60-10,000 cps plus or minus 3dB, 7½ ins/sec. 50-15,000 cps plus or minus 3dB, wow and flutter—less than 0.2 per cent at 7.5 ins/sec., input levels (for full depth recording). Input (1) minimum signal 2mV RMS, Input (2) minimum signal 400mV RMS—input impedance 1 megohm and .5 megohm respectively, track separation (stereo) —approx. 40dB, signal/noise ratio—unweighted including hum—52dB, lower track rejection on monaural application, equal to, or greater than 60dB at 400 cycles, power consumption—115 watts, erase and bias frequency—approx. 68 Kc/s. fast winding times—less than one minute for 1200-ft standard tape (either direction), recorded track width—0.083in for the type 422 twin unit and 0.043 for the 424 ¼ track unit.

Trade price of the unit is £235/8/ inc. sales tax, and further inquiries should be directed to the Australian agents for Ferrograph, British Merchandising Pty. Ltd., of 60 Clarence Street, Sydney.

TRANSISTORISED INSTRUMENTS — RADIO HOUSE



The miniature transistorised test equipment pictured at the left is part of a range recently released by Radio House Pty. Ltd.

THE unit uppermost in the photograph is an RF Field Strength Indicator whose size alone (king size cigarette package style) would make it an attractive proposition. Basically the instrument is an absorption type wavemeter with band-switched inductors and a variable tuning capacitor. Indication is by means of a miniature (¾in square), 200 microampere, tuning meter.

The bandswitch has five positions and the frequency covered is 2 to 200Mc continuous. An extendable, plug-in, 12in pick-up antenna is provided with the unit, in addition to a crystal earpiece for monitoring of the audio on transmissions. Our tests showed this to be adequate for indicating the presence of audio on a carrier but the level was too low to judge audio quality.

The case is finished in grey hammertone enamel and has four rubber feet and a small permanent magnet attached to its base. This enables it to be used for the testing of mobile installations without danger of damage to the vehicle finish.

The second instrument illustrated is a transistorised test oscillator for use in aligning broadcast band receivers. Housed in in attractive black plastic case it uses two transistors, one as a switched fixed-tuned RF oscillator and the other as a 400 cycle audio oscillator for modulation purposes. Provision has been made to apply external modulation, if desired, and the output of the audio oscillator is taken to a phone jack for use in testing audio amplifiers, etc.

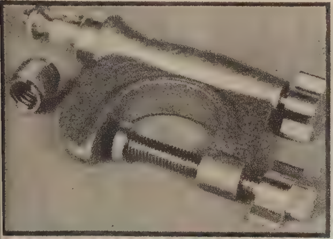
The RF oscillator operates on the following nominal fixed frequencies: 455, 535, 640, 1000, 1400, and 1600Kc/s.

Further enquiries should be directed to the Australian agents, Radio House Pty Ltd., 296 Pitt St. Sydney. (K.W.J.)

MICROPHONE OR CAMERA CLAMP

This little gadget, made by AKG, is one of the handiest we have seen for a long time. It provides a neat solution to the old problem of how to support a microphone or camera without having to transport a bulky and awkward stand or tripod.

SMALL enough to tuck away in a corner of the recorder case, "gadget bag," or coat pocket, it will nevertheless perform most of the functions of a full size unit. Clamped to a table, back of a chair, car body, etc., it will support its load at almost any angle by means of a quickly adjustable, positive locking, ball and socket head.



A minor criticism is that it could well be fitted with protective felt or rubber surfaces to avoid marking furniture, car duco, etc., but there is no reason why the individual cannot add this refinement himself.

The head is provided with a standard camera thread, to which is fitted an ingenious adapter carrying a wide range of microphone threads, both internal and external.

Further information may be obtained from the importers, Amalgamated Wireless (Aus.) Ltd., and supplies should be available through normal trade channels. Price is £2/16/8, plus tax. (P.G.W.)

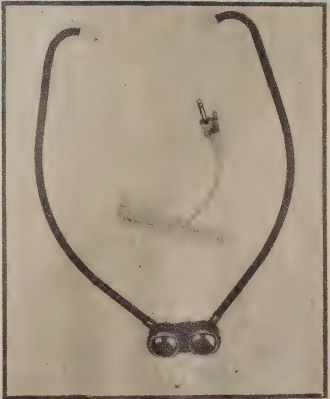
Novel Stereo Headphones

The interest aroused by our article on Stereo Headphone Amplifiers in the January, 1961, issue has resulted in a number of stereo headphones (of both commercial and amateur manufacturers) being presented to us for our inspection and possible comment.

AMONGST the latest to reach us is the pair illustrated, manufactured by the Sawafuji Co. .td., of Japan, and distributed in Australia by 'rice's Radio, of Angel Place, Sydney.

The main basis of this unit is a pair of "button" ype earphones commonly used with transistor adios and hearing aids. These are mounted on plastic frame with two acoustic tubes and ear-lugs conducting the sound to the ears. Separate ords and plugs are provided for each unit the npedance of which is 8 ohms.

As one would expect of so small a unit, the ass and treble response falls off somewhat from fairly evident peak at around 2Kc. The stereo ffect (as with most headphone type units) is xcellent and taking into consideration the low price asked (35/ retail) they should make a suitable unit for an inexpensive personal stereo outfit.



Further inquiries should be directed to the agents, Price's Radio, of 5-6 Angel Place, Sydney. (K.W.J.)

The SHURE Ten-Four

Controlled magnetic or carbon

A rugged hand microphone designed for outdoor public address and mobile communications. Prices. Magnetic from £10/16/-, Carbon from £11 17 -.

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AWA RONETTE

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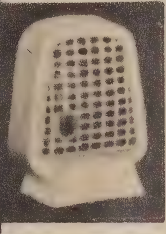

Type 44

PRICE

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Hand or desk mounting,

counter-balanced base, ivory plastic housing.

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Creates precision sound

Fidelity of sound is attainable only through planned refinement in each of an instrument's working parts. This *PRECISION FEATURE* — above all else — singles out the *AKAI* as a superlative recording and playback system. Professional facilities for recording excellence provided by the AKAI include Calibrated V.U. Meter, Editing Pause Lever, Synchronous Motor for constant tape speed, simple wrap-around tape threading, three-digit index tape counter and new exclusive full fidelity (40-20,000 cycle) magnetic heads.
Check and compare these features with any other recorder and AKAI will be your choice.

EXCLUSIVE FEATURE
Every AKAI is supplied with a "sync-rod" which enables recorded sound to be synchronised with movie pictures.

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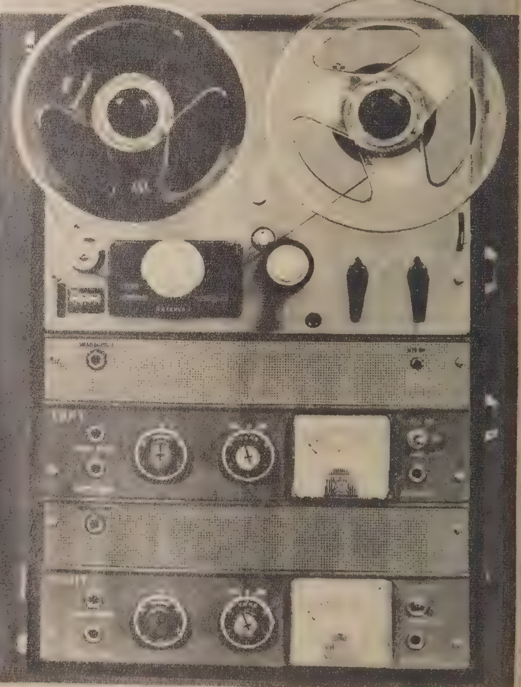
for full descriptive literature and name of nearest stockist.

SPECIFICATION FOR M5
(Illustrated)

FREQUENCY RESPONSE. 40 to 20,000 CPS at 7½ ips. 40 to 14,000 CPS at 3¾ ips. **TAPE SPEEDS**: 1⅞, 7½ or 3¾ ips. **SIGNAL TO NOISE RATIO**: Better than —45dB. **WOW AND FLUTTER**: .07%, RMS at 7½ ips. **TRACK SELECTOR CONTROL**: Precision enclosed Head switching provides the following "inline" facilities — Tracks 1-3 or 2-4 Monaural and either 2 or 4 Track Stereo Record and Replay. **MOTOR AND DRIVE**: Balanced hysteresis synchronous motor, belt coupled to speed stabilized flywheel/capstan tape drive. **AMPLIFIERS AND EQUALISATION**: Up to 6 watts per channel at low distortion with record and replay equalisation to Broadcast (NAB) Standards. **CHANNEL SEPARATION**: Better than 80dB at 1,000 CPS. **INPUTS AND OUTPUTS**: Low level, high impedance microphone input, high level line input; high impedance head output, 8/16 ohm amplifier output. **INDEX COUNTER**: Accurate, three digit type. **REEL SIZE**: 7" maximum (up to 2,400 ft. of tape). **DIMENSIONS AND WEIGHT**: 14" x 20½" x 8¾"; 47 lbs. **INTERLOCKING CONTROLS**: Prevent accidental erasure of recorded tapes; instantaneous start and split second acceleration. **OPERATING POSITION**: Vertical or Horizontal. **MICROPHONES**: Top quality dynamic finished brushed chrome and black.



S823A

LOWREY ELECTRONIC ORGAN

Illustrated below is the "Church" model, one of twelve in the range of electronic organs produced by the Lowry Organ Co. of Chicago and marketed in Australia by Rees Wills Pty. Ltd., of 165 Clarence Street, Sydney.

AS with all Lowrey instruments it is a two-manual unit, this model having 61 notes in each of the manuals. The pedal board has 25 notes. Other features include: Vibrato with two speeds and two depths, separate solo tabs for all voices plus each manual and the complete organ six percussion presets for novelty effects and a noiseless expression pedal based on the variable capacitance effects.

Voicing of the organ is: Swell registration — Flute 16', Trom. 16', Cello 16', Flute 8', Geigin 8', String 8', Clarinet 8'. Trumpet 8', Flugel Horn 8', Oboe 8', Flute 4', String 4', Piccillo 2', Quint 5 1-3', and Twelfth 2 2-3', Great registration — Flute 16', Clarinet 16', Melodia 8', Diapason 8', Viola 8', Cornet 8', Trombone 8', French Horn 8', English Horn 8', Voxhumana 8', Flute 4', String 4', and Clarion 4'.

Inter-manual and pedal couplers for 8, 4 and 2' are also provided.

The tones in the Lowrey organ are produced from 12 Hartley master oscillators and the division of frequencies is achieved by Eccles-Jordan dividers. The register is split into groups, enabling complete control of waveform and harmonics in all positions on the keyboard. All voices are completely additive.

The patented Lowrey glide, an ingenious device that allows the pitch of the organ to be lowered a semi-tone and raised again at will, is an optional extra on this model. Authentic instrumental effects such as Hawaiian guitar, the string glisando and the trombone smear are produced with this unit.

The organ is supplied with two speakers, a 15in woofer and a mid-range unit and a 40-watt amplifier. With the in-built stereo facilities it could be compared with a 15-rank pipe organ. Price of the instrument is £1,600 plus tax, and further inquiries should be directed to Rees Wills Pty. Ltd., of 165 Clarence Street, Sydney.

OUTPUT TRANSFORMERS from A & R

A recent addition to the range of transformers manufactured by A. and R. Electronic Equipment Co. Pty. Ltd., 378 St. Kilda Road, Melbourne is the high quality, grain oriented output transformer pictured below.

DESIGNED specifically for high quality audio applications, this transformer has a 6600 ohms P-P primary, with screen taps 20 per cent either side of the CT. Secondary impedances are 3.7, 8 and 15 ohms. Power handling capacity is quoted as 15 watts at a frequency of 25 cycles.

The grain oriented core, high primary inductance and low leakage inductance combine to give a very good overall frequency response.

Finished in light grey, baked hammertone with black laminations, the appearance is very pleasing. Connections to both primary and secondary are brought out on colour-coded flying leads, requiring only two chassis holes in addition to the four mounting holes.

This transformer is a further example of the improvements continually being made in the field of audio engineering, notably with respect to increased frequency response and greater power handling capacity for a given physical size.

An extensive range of transformers for both audio and power applications is available from A. and R., meeting requirements in almost every branch of the electronics industry. Further details and prices may be obtained from the manufacturers or from Watkin Wynne Pty. Ltd., 21 Falcon Street, Crow's Nest, N.S.W., who have recently been appointed the N.S.W. agent.

RADIATION DETECTOR

CURRENTLY available from Philips Electrical Industries Pty. Ltd. is a useful detector for gamma and beta radiation. It uses two built-in G.M. tubes for gamma radiation, and an external pick up for beta radiation.

The instrument is suitable, among other things, for demonstrating the radioactive contamination of certain areas and buildings, personnel, equipment, foodstuffs, water, etc., and for testing the effectiveness of decontamination measures.

The monitor is fitted with eight scales coupled mechanically to the range selector. In this way the corresponding calibration becomes visible on the scale as soon as the required range and the appropriate G.M. tube have been adjusted.

The instrument is shock and vibration proof and can be used at temperatures ranging from —30 deg. C. to 50 deg. C. It is also watertight and insensitive to differences in atmospheric pressure to 40,000ft. The outer cabinet is made of tough plastic which can be easily decontaminated.

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OFF THE RECORD — NEWS & REVIEWS

SOUND-ON-FILM RECORD MASTERS

Unless I miss my guess, some of the achievements of the film industry in the matter of magnetic sound recording have had an impact on the record industry in showing the way—possibly—to better quality master recordings. At least, such would appear to be the case from a recent announcement by the distributors of "Command" Records.

By Neville Williams

LIKE most other reviewers, or at least those concerned with technicalities as well as the contents of new discs, I have been acutely conscious that the limitation on ultimate quality has been set, not by the disc to which I am listening, but by the medium from which it came.

Many times, I have had to listen to discs with quite a noticeable hiss in the background, which disappears at the end of each track, only to reappear a split second before the next number commences.

In other cases there has been evidence of wow, or speed change or plain, old-fashioned hum.

Distortion, too, has not been uncommon, though it is harder in this case to decide whether it comes from the tape, or the preesnt disc, or from both. And, of course, there's the old problem of tape "print-through" whereby the contents of each layer of tape on the reel appear spontaneously, at low level, by magnetic transfer, on the layers adjacent to it.

To be sure, these things shouldn't be encountered. Coming off professional machines, tape recordings can be so good that it's hard to imagine anything better. What's more, the best disc recordings carry no obvious hint that they have been dubbed from another medium.

But . . . the sorry fact remains that the tape medium does so often intrude, leading to the assumption that the tolerances which have to be observed to obtain really good tape masters are uncomfortably narrow for the job which has to be done.

BASIC PROBLEMS

Attacking these general problems, the manufacturers of Command records maintain that they are up against basic limitations of the tape medium in its present standard form. They maintain that these limitations prevent them moving from the goal of merely "excellent recording" to "superb recording."

In particular, they mention:

(1) The last vestiges of flutter which may not be immediately apparent as such but which cause a subtle degeneration of ultimate musical quality.

(2) An inevitable degree of interlayer print-through, which produces a vestigial amount of acoustic confusion.

(3) The very real problem of maintaining an adequate signal-to-noise ratio when the requirements of multi-channel recording make it necessary to reduce the width of individual tracks.

To this could be added the observation that, when these tracks are later reproduced through separate loudspeaker systems, the noise content from each channel adds up, as far as the listener is concerned.

A possible answer to these problems was seen in the use of magnetically coated 35mm. film stock, as used by the theatre industry and developed for their multi-channel sound spectaculars. Likely advantages would include:

(1) Less flutter, due to the greater stiffness, mass and inertia of the base material, together with the high degree of refinement which has been achieved in film transport mechanism.

(2) No "print-through" problems, due to greater thickness of the medium—5 mils instead of about 1½ mils.

(3) Much greater track width which, together with possible dynamic control facilities, permitting extremely wide dynamic range, with a very low signal/noise ratio.

Unfortunately, one very important problem had to be faced—that of cost. Command engineers worked out that, ever and above the initial expense of new recording equipment, the film would cost 10 times as much as ordinary recording tape and take up a great deal more storage space.

Was it worth the candle?

Apparently it was . . ."because it is Command's policy to seek out every possible advance in sound reproduction, no matter how marginal it may seem or how costly it may be." (The foregoing, as you might have guessed, is a direct quote from the company's not-exactly-modest publicity.)

Sufficient to say that, having decided to adopt 35mm film for their master recordings, Command went the rest of the way by hiring the Carnegie Hall, an orchestra of more than 60 players, and facing them up with 14 microphones feeding into a 12-channel mixing console.

So goes the story. Time alone will tell whether the venture will prove successful commercially or whether it will produce a better end result for the record user—not just in the first few discs, but as a regular feature.

The system may prove unwieldy for anything but premium recordings but, then again, Command's move might show the way to better things.

RELEASES ON TAPE

Still on the subject of tape, but in a quite different connection, I was interested to note an announcement in the overseas Press to the effect that the World Record Club in England has decided to make available all their new releases on tape as well as disc.

The releases will be available on 5in spools to play at 3¾ i.p.s. or on 7in stereo spools playing at 7½ i.p.s. The tapes are to be packaged in boxes carrying labels which will be miniatures of the record jackets.

Tracking weight:

THE tracking weight, or downward pressure on a pickup stylus, is a subject of considerable importance, but it is also one which is frequently misunderstood.

Ideally, the tracking weight should be kept as low as possible because, in general, reduced tracking weight means reduced wear of both the stylus and the record grooves. However, many enthusiasts have tended to regard this as the main consideration, not realising that they are paying a heavy price in other respects.

The fact is that pickup cartridges generally need to work with a weight on the stylus point of the order quoted by the manufacturer. It has been determined, in turn, by the design of the cartridge and, in particular, by the mass of the moving stylus assembly and its compliance.

If an attempt is made to operate a given cartridge with less than the prescribed weight on the stylus point there is every chance that the stylus will tend to ride up the sides of the groove, instead of following its side-to-side deviations. If it does so, distortion will result.

This distortion is not constant but will vary with the nature and amplitude of the groove recording. Thus an underweighted stylus may seem to play certain records perfectly, yet will introduce severe distortion on others —or on specific passages—where the tracing problems are greater. As a result, there is a tendency to blame the records where, in fact, the explanation may simply be "not enough weight."

Therefore, while there is every reason not to exceed the weight recommended by the cartridge manufacturer—because it can only increase record and stylus wear to no purpose—caution must be exercised in reducing the weight. By all means try it, but, if the pickup tends to jump grooves or distorts on passages which it otherwise would play cleanly, it can mean that you have gone too far.

In practical terms, the average modern crystal or ceramic cartridge can seldom be relied upon to play cleanly below about four or five grams. Similarly, the average high quality magnetic cartridge needs two to three grams. These figures apply irrespective of whether the arm itself is capable of allowing lower tracking weights.

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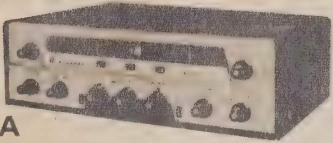
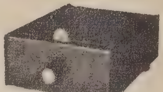
24 WATTS
FM/AM/AM
STEREO
TUNER
AMPLIFIER



SM-B200A

New SM-B200A FM/AM/AM stereo tuner-amplifier consists of an FM tuner with wide band range, two AM tuners, a preamplifier and a powerful 24 watts power amplifier.

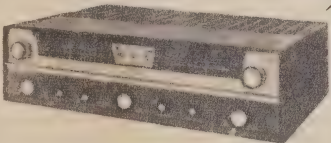
It is equipped with separate treble and bass controls for each channel, and a stereo presence control, which is for emphasising stereo effect. Thus, every possible mechanism is well adopted to this unit and the unit can be used as a versatile stereophonic tuner-amplifier.



TRANSISTOR HEAD-AMPLIFIER STP-1

To use a high-quality magnetic cartridge with SM-B160 and SM-B180. The Pioneer STP-1 transistorised stereo head-amplifier with 4 transistors is being provided for use with the SM-B160 and SM-B180 for low output cartridges. By simply connecting the STP-1 with shielded wire between the SM-B160 and SM-B180 and a pick-up, any type of cartridges with output of 3 millivolts to 30 millivolts can be used.

28 WATTS
FM/AM/AM
STEREO
TUNER
AMPLIFIER



SM-B201

The SM-B201 is a versatile stereo tuner-amplifier with the similar functions as the SM-B200. Additional features are provided such as whistle filter to prevent beat interruption when listening to broadcasts and DC operation of the preamp tube filaments to ensure freedom from hum.

20 WATTS
FM/AM/AM
STEREO
TUNER-
AMPLIFIER

SM-B180

A completely assembled stereo receiver combines 2AM and an SW tuner which enables the listener to receive every broadcast source, a built-in preamplifier, and 20 watts stereo amplifier. It also provides stereo disc reproduction by adding a stereo record player and playback of stereo tape with a stereo tape recorder.

These amplifiers are only a part of the extensive range of amplifiers, tuners and speakers available. For further information contact your high fidelity dealer or write to the **SOLE AUSTRALIAN AGENTS**

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Inquiries indicate that there is no present intention of following suit in Australia. While the World Record Club is not unaware of the possibilities of tape, they are able to offer discs of such quality and at such a price that there is little demand for another medium, at least for ordinary home entertainment.

And this, in fact, just about seems to be the crux of the matter. An enormous number of tape machines are currently in use by the public, but for purposes other than routine domestic entertainment. What's more, their users seem largely to be content to buy and play disc records when entertainment is what they want. Suppliers, understandably, seem content to let them!

NOT WITHOUT LOGIC

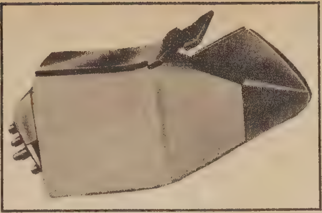
Perhaps it isn't as illogical as it might sound to do so.

The aforesaid tape machines conform to a wide variety of patterns and standards and few of them have any real pretense to fidelity. Commercially, it isn't sufficient merely to observe that so many people have tape recorders. It is a matter of deciding how many people could play tape conforming to certain standards—if they wanted to."

Nor is the question of standards becoming any clearer.

While silence largely surrounds the new 1 7-8 i.p.s. equipment proposed in America by C.B.S. Laboratories, it seemed that the local scene was settling down to the four-track formula and with the emphasis, for routine recordings, on 3¾ i.p.s.

However, I have heard quite a bit of dissatisfaction from tape users with the practice. Some of the machines have given more than their share of mechanical troubles. Signal/noise ratio has been a problem, heads have shown a tendency to rapid wear and/or fouling, while fades and drop-outs are more likely due to the narrow tracks.



Well known in the U.S. for high quality pickups and cartridges, Pickering are now making available, to other than professional users, their Stanton Calibration Standard cartridge. Weighing 12 grams, the cartridge is designed to track in typical professional arms at between 2 and 3 grams. Response is claimed as being within 2db. from 10cps to 17Kc. and within 1db between 20-cps and 10Kc. Nominal output is 5 millivolts per channel and channel separation is quoted as 35db. Models are available with interchangeable 0.7 mil., 1.0 mil. and 2.5 mil. styli, each stylus assembly being supplied complete with a calibration chart. (Ad. Auriema, Inc., 85 Broad, St., New York 4, N.Y.)

In itself, the much-publicised economy may have over-reached itself. I have heard people complain that it's too hard to remember where particular items are and cataloguing becomes a bore. Many have expressed the opinion that twin-track is a better all-round compromise, whether it be twin track mono or twin track stereo.

Perhaps it is, but that's not the point. It's just that continued vacillation and argument pushes the hope of any real standard further into the future.

Meanwhile, discs continue to sell like the hot cakes they are.

The Sound of Christmas

ORGAN AND CHIMES CHRISTMAS ALBUM. Charles Smart, Organ; James Blades, chimes. Mono. Decca Ace Of Clubs, ACIA-1040.

Available at the Club price, this disc should be a very useful one for churches at the Christmas period. At times the organ is suitably ponderous; at times it retreats self-consciously from the characteristic off-pitch sound of the chimes. However, it's all very straightforward, conventional and traditional — exactly as it's supposed to be.

The titles: "Silent Night," "Joy To The World," "Hark, the Herald Angels," "Greensleeves," "Good King Wenceslas," "O Little Town Of Bethlehem," "O Come All Ye Faithful," "It Came Upon The Midnight Clear," "Once In Royal David's City," "I Saw Three Ships," "O Tannenbaum," "While Shepherds Watched," "In Dulce Jubilo," "From Every Spire" and "The First Nowell."

Technically, well recorded.

* * *

CHRISTMAS WITH CONNIE, Connie Francis, The Rita Williams Singers and Geoff Love and his Orchestra. Mono. M.G.M. O2-7574.

Those who can only think of Connie Francis as the girl who sings with a big beat band are in for a surprise with this new disc, recorded in England.

On Side 1 she prevents a bevy of conventional Christmas songs, singing them "straight" — and engagingly — against a good but strictly conventional orchestral backdrop.

But transformation is complete on Side 2, where she presents "Ave Maria," "The Lord's Prayer" and four traditional carols on a strongly devotional note. Nice work, Connie!

Technically, the recording is very good also, except for the use of some kind of resonant filter in the mic. circuit during "Twelve Days Of Christmas" on Side 1 and elsewhere on Side 2. It might have been an attempted "effect" or it might have been introduced for other reasons but one could be excused for thinking that Miss Francis had suddenly found it necessary to switch dentures!

I mention it, not because it will reduce your enjoyment of the record, but I gather that reviewers are expected to notice such things.

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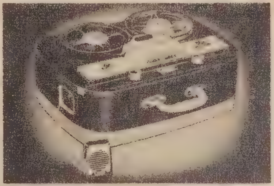

RECORDING TAPE: 1200ft spools of high-grade tape on 7in reels, usually £2.19.6, now 35/-. 1800ft long playing tape, 55/-.

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ALL ARTICLES PLUS FREIGHT

PARAGON RADIO

479 PARRAMATTA RD., LEICHHARDT
LM 9402. TOP TAVERNERS HILL

THE LAST MONTH OF THE YEAR, The Kingston Trio, produced by Voyle Gilmore. Stereo. Capitol ST-1446.

This one scores on just about every count. It is superbly recorded, with diction, balance and spread to gladden the heart of a hi-fi enthusiast, and just a touch here and there to underline that this indeed, is stereo.

The Kingston Trio are also at their best, with not a sour note to mar the presentation. In addition to bass and banjo, by the way, they use a Greek Bouzouki, rather similar in character to the lute or mandolin.

The program itself has to do with Christmas — but in folk songs and melodies selected from less obvious sources and each one the subject of informative comment on the jacket. They include:

"Bye Bye Thou Tiny Little Child," "The White Snows Of Winter," "We Wish You A Merry Christmas," "All Through The Night," "Goodnight My Baby," "Go Where I Send Thee," "Follow Now Oh Shepherds," "Somerset Gloucestershire Wassail," "May Mild," "A Round About Christmas," "Sing We Noel" and "The Last Month Of The Year."

This is one that I can recommend without hesitation.

* * *

A DING DONG DANDY CHRISTMAS; The Three Suns, produced by Al Nevins. Mono, R.C.A. L-101135.

Living up to their reputation for exploiting novel sounds — or rather ordinary sounds in a novel way — the Three Suns give the treatment to fourteen traditional Christmas songs.

The result is a disc full of excellent party music, with the emphasis on melodic rhythm, and with tubas and chimes in there mixing it with guitar, accordion, bells and the inevitable Hammond organ.

As I said, these are Christmas songs, with not a carol among them. Nor did I hear a single bit of distortion or noise to mar the quality of the recording.

* * *

A CHRISTMAS SOUND SPECTACULAR, John Klein at the Carillon Americana, with Orchestra and Chorus. Produced by Herman Diaz, Jr. Stereo. R.C.A. SL-101145.

"Sound Spectacular" is an appropriate name for this particular disc. If mention of Christmas and a Carillon conjures up the idea of a record which a local church could feed through its P.A. system, forget it — unless, of course, the church wants to acquire a reputation for the unusual.

The fact is that this disc belongs more to the rhythm-percussion class, with the rather unusual exception that the sounds of a very complex carillon, and the Christ theme, substitutes for the rather wearying bashing of jazz drums.

Not all the sounds are entirely successful and some of them are even incongruous, but these are very much in the minority.

If you're looking for some novel hi-fi sound, with plenty of obvious stereo and rather more varied than the usual percussion fare, you'll find it on some of the tracks here.

The following records were reviewed for last Christmas but are still available in the catalogues:

MUSIC OF THE MEDIEVAL COURT AND COUNTRYSIDE (For the Christmas Season). New York Pro Musica Antique, Directed by Noah Greenberg. Mono. Festival FL-7185.

A record for those with a studious turn of mind, this covers Christmas music from the twelfth to the sixteenth centuries, bringing together Latin and vernacular, the deeply religious and the festive. Well recorded and well presented, with an accompanying booklet of explanatory notes.

CHRISTMAS CAROLS. Temple Church Choir. Organist and Conductor, Dr G. Thalben-Ball. Stereo HMV OCSD-1281.

The emphasis here is predominantly on the choir and organ of London's historic Round Church, though the theme happens to be Christmas. Technically, the disc suffers from more than its share of background noise.

CHRISTMAS SURPRISES. From the Ralph Hunter Choir. RCA. Mono. L-10911; stereo SL-10911.

A choral presentation of Christmas songs and carols, tending to err somewhat on the side of orchestral over-embellishment, at least for those with conservative tastes. Technically good, with a preference for the stereo version, where practicable.

CHRISTMAS JOY, George Melachrino and His Orchestra, RCA Mono. L-10909; stereo SL-10909.

A Mixture of carols and Santa-sleigh-reindeer music, with plenty of jingles and bells, mingled with the Melachrino strings. Quality rated as "superb."

MANTOVANI CHRISTMAS ALBUM. Mantovani and His Orchestra. Mono. Decca. LKA-4235.

Traditional tunes undergo a lot of arrangement and orchestration but they add up to some quite impressive sound in the Mantovani manner. Technically, tops.

CHRISTMAS CAROLS. Billy Vaughn and His Orchestra. Mono. London HAA-2195.

Billy Vaughn attempts with wind instruments what Mantovani, above, does with strings. Unfortunately, it doesn't work out quite as well, either musically or technically.

WHITE CHRISTMAS. Sung by Pat Boone. Stereo, London SAHA-7514.

Smooth and relaxed. Pat Boone presents nine familiar carols and five familar Christmas songs. The disc is technically excellent but with a slight bias toward the treble register.

CHRISTMAS WITH GISELLE. Giselle Mackenzie. Mono. RCA L-10919.

Side 1 devoted to carols and traditional songs, side 2 to Santa, wooden soldiers, bells and reindeers. Sung, sometimes in English, sometimes in French and with good orchestral backing, it makes pleasant listening, both musically and technically.

THE MERRIEST OF CHRISTMAS POPS. Mimi Himes, the Skip-Jacks and the orchestras of Esquival and Ray Martin. Mono. RCA. L-10910.

No carols on this one, but a collection of songs and titles, some humorous, which can somehow be pinned to the Christmas bandwaggon. A good party disc, though, and nicely recorded.

HARK, THE STARS OF HOLLYWOOD SING. The Voices of Christmas, with Les Brown and His Band. Mono, Coral CL-7654.

An on-the-spot recording of a charity concert at the Beverly Hills Hotel, which relies for any distinction on the fact that it was attended by certain Hollywood stars. A not very convincing presentation.

Also listed, but not available for review in time for this issue are the following discs.

A CHRISTMAS CAROL. A new recording of Dickens' immortal tale, with cast supported by the Bach Choir and Jacques Orchestra, conducted by David Willcocks. Mono and stereo, World and Light Record Club.

AUSTRALIAN CHRISTMAS CAROLS (William James). Sydney Symphony Orchestra, conducted by Sir Bernard Heinze and recorded at the Sydney Conservatorium. "Telling not only of the birth of the Christ-Child but also of Christmas in the bush." Mono and stereo, World and Light Record Club.

FOR IT IS CHRISTMAS. The story of Chrstmas, with narration, solo artists, choir, organ and full symphony orchestra. Mono and stereo. World and Light Record Club.

A WINTER ROMANCE — DEAN MARTIN. Songs about reindeer, snow and more snow, love and snow, etc. With Gus Levene's Orchestra. Mono and stereo. World and Light Record Club.

CHRISTMAS WITH CHET ATKINS. Classical guitar and electric guitar, accompanied by the Anita Kerr Singers. Medley of Christmas song tunes and traditional carols. Mono, RCA L-101162.

A YULETIDE SONG FEST FOR THE ENTIRE FAMILY. Rosalind Ellis (mezzo-soprano). Giorgio Tozzi (bass), with Orchestra and Chorus conducted by Lehman Engel. Traditional Christmas carols, sung by two well-known Metropolitan Opera singers. RCA. Mono L-16299; stereo SL-16299.

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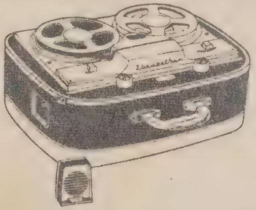

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(bolero), "Do-Re-Me" (paso doble), "My Favourite Things" (vals creole), "Sixteen Going Seventeen" (baion), "No Way To Stop It" (samba-batuque), "Climb Every Mountain" (bolero mambo), "The Lonely Goatherd" (baion), and "How Can Love Survive" (marcha).

Technically the quality is excellent, with plenty of everything to show off your hi-fi gear.

* * *

TALKIN' TO YOUR HEART; Jim Reeves. Produced by Chet Atkins. Mono. R.C.A. L-101137.

Jim Reeves, described as a "big, square-shouldered Texan singer" on U.S. radio networks and television, sings but a little on this disc, concentrating rather on a dramatic narration of melodramatic tales to fit the varied musical themes.

He does it all very well but only you can decide whether you do, in fact, want Jim Reeves to "talk to your heart." If you do, he'll tell you about "Trouble In Amen Corner," "Ships That Never Come In," "Annabel Lee," "The Gun," "The Farmer And The Lord," "Shifting, Whispering Sands," "Old Tige," "Why Do I Love You," "Spell Of The Yukon," "Men With Broken Hearts," "Too Many Parties" and "Seven Days."

Quality of recording is good.

* * *

THE DESERT SONG, Sigmund Romberg; Lyrics by Harbach, Oscar Hammerstein II and Mandel. Conducted by Bobby Richards. Produced by Cyril Ornadel. Stereo. World Record Light Music Club, LM7022.

"Average only" was my reaction to this latest recording of the popular "Desert Song."

Technically, the recording is good, as also is the orchestral work, but with one or two exceptions, the singers perform as individuals rather than as members of a cast. It's a pity because a bit more "togetherness" and more selective microphone placement would have made all the difference to the end result.

* * *

THIS IS NORMAN LUBOFF, Produced by Lee Schapiro, RCA Stereo SL-101049, Mono L-101049.

With orchestral backing, the Norman Luboff choir assumes a wide variety of moods to produce this highly listenable program of choral music—or should we say popular music in choral style?

Romance, blues, jazz, show tunes and spirituals, follow one upon the other from "All The Things You Are," to the "Beer Barrel Polka" and on to "Let There Be Peace on Earth."

Needless to say, under the hand of Norman Luboff, it's all very well ordered sound, and RCA engineers have done a good clean job of recording, the mono and stereo versions each good in their own right.

* * *

THINGS TO DO ON A NIGHT IN VIENNA, Presented by 101 Strings. Mono. W. and G. WG-B-1088. (Also available in stereo).

Full-bodied and with plenty of "boomp" in the bass register, 101 Strings add this disc in Viennese mood to their already formidable list of titles. It's pleasant listening and good buying for anyone with a place in their collection still for Viennese music.

The titles: "Vienna City of my Dreams," "Blue Danube," "Pizzicato Polka," "Artist's Life," "Sweets For My Sweet," "Tales From The Vienna Woods," "Vienna Blood," "Cold Coffee and Hot Jazz," "Perpetual Motion" and "A Merry Widow."

The quality—excellent with no noticeable surface noise.

* * *

THE IMMORTAL VICTOR HERBERT; The Robert Shaw Chorale and Orchestra, Stereo, RCA SL-16300.

Thoroughly enjoyable is this new offering from the Robert Shaw Chorale and Orchestra. I must stress this last word, because the orchestra here weaves a rich, broad pattern of sound which alternately frames and envelopes the soloists and the chorus.

From start to finish the sound is clean and brilliant, the melodic line sustained and the direction as smooth as silk.

The Victor Herbert evergreens include: "The Streets Of New York," "Every Day Is Ladies Day," Kiss Me Again," "I Want What I Want," "Tramp, Tramp, Tramp," "A Kiss In The Dark" "Thine Alone," "March Of The Toys," "Toyland," "Ah, Sweet Mystery Of Life," "I'm Falling In Love," "Sweethearts," "When You're Away," "Gypsy Love Song," and "Italian Street Song."

If you're looking for a Christmas present, which will be welcomed in any circle, may I suggest this one?

* * *

THE NORMAN LUBOFF CHOIR, You're My Girl. Produced by Lee Schapiro. Mono, RCA L-101154.

Norman Luboff uses eight male and four female voices, plus a small instrumental group, to produce this unashamedly sentimental program of vocal music. But even if it is sentimental and trivial, it's nevertheless easy on the ear —the kind of sound that's tailor-made for relaxation.

And technically, the recording is as smooth as the sound itself.

Just a few of the titles: "My Ideal," "Star Eyes," "Sleepy Time Gal," "You Beautiful Doll," "The Object Of My Affection." The rest are in similar vein. For lovers and newlyweds?

* * *

FOLLOW THE BOUNCING BALL; Community Singing with Orchestra and Chorus Directed by Norman Leyden. Stereo, RCA Camden CAS-79. (Also available on mono.)

In case the term doesn't immediately register, "Bouncing Ball" harks back to the community singing shorts which were once a feautre of film programs.

Remember the animated blob which bounced from word to word, keeping everyone in time?

If you do, then you'll certainly remember "For Me And My Gal," "You Are My Sunshine," "I Wonder Who's Kissing Her Now," "Let The Rest Of The World Go By" and a dozen other chestnuts from the heydey of community singing.

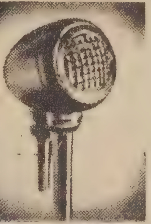
They're all grouped here, for you to join in, if you want to. Alternatively they're played well enough and sung well enough for pleasant listening. The quality of reproduction is quite good, also.

* * *

MORIAH COLLEGE JUNIOR CHOIR. Arranged and conducted by Darrell Bailey. Mono, Rex RL30-013.

Established by the Jewish community in Sydney, the Moriah College adds Jewish culture, language and music studies to the usual curriculum. The College Choir featured here was the re-

(Continued on Page 127)



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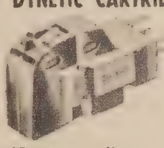

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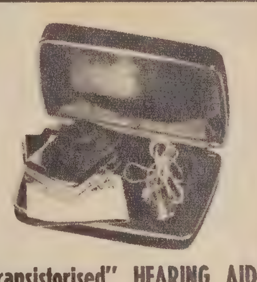

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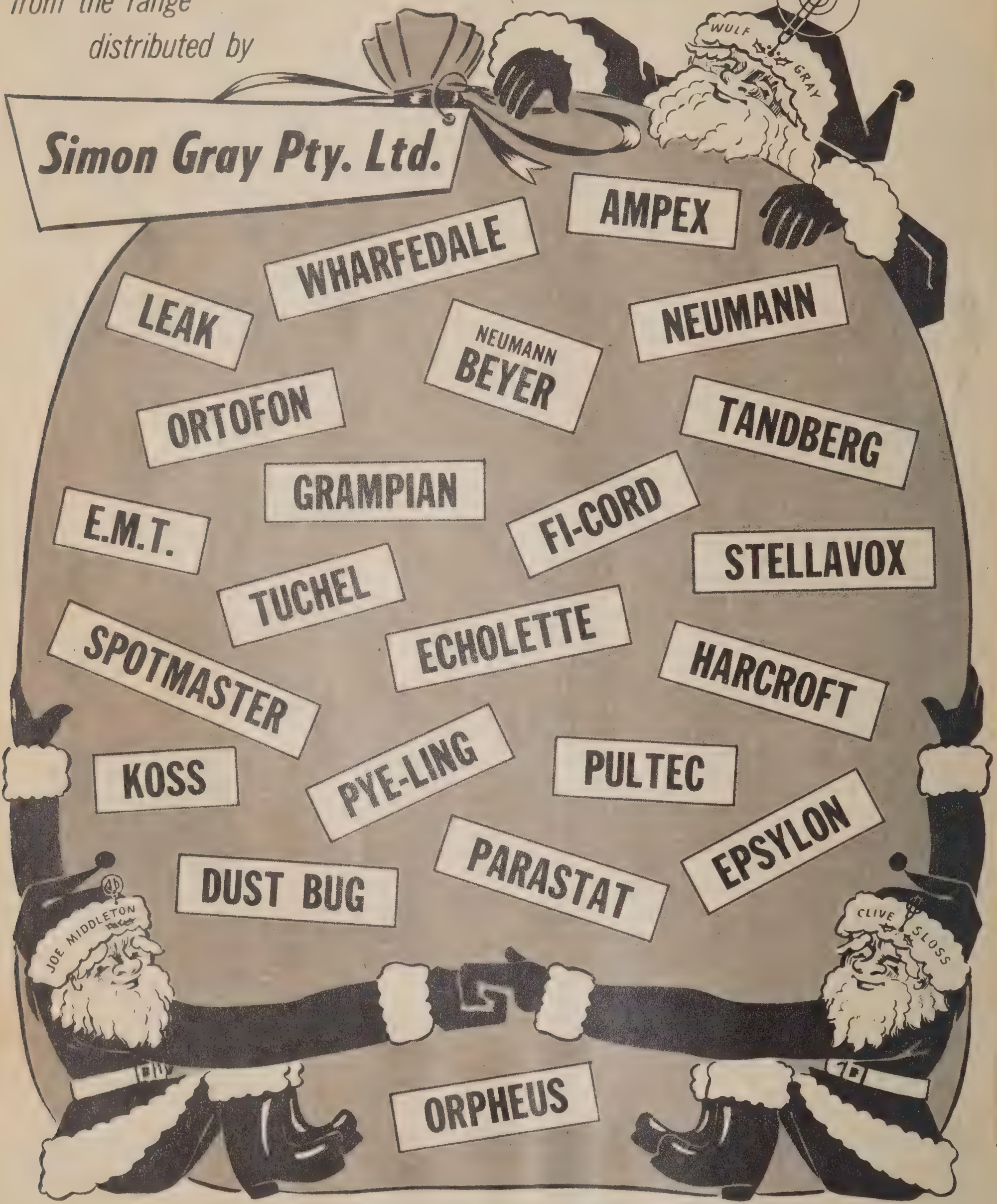
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IN REVIEW—By JULIAN RUSSELL

ANSERMET — "More Than Usual Merit"

Moussorgsky—Ravel: Pictures at an Exhibition. Liszt — The Huns. Orchestra of the Swiss Romande conducted by Ernest Ansermet. Decca Stereo SXL2195.

Ravel—Mother Goose Suite (Complete). Debussy—Nocturnes. The Orchestra of the Swiss Romande conducted by Ernest Ansermet. Decca Stereo SXL2062.

Rimsky-Korsakov—Scheherazade, Symphonic Suite, Op. 35. Borodin-Polovtsian Dances from Prince Igor. Orchestra of the Swiss Romande, and, in the Borodin, with the Choeur des Jeunes and Choeur de Radio Lausanne, conducted by Ernest Ansermet. Decca Stereo SXLA2268.

I have bracketed these three discs together because they have so much in common. The two main features of resemblance might be summed up as engineering of more than usual merit and playing of the utmost sensitivity.

Most of Ansermet's work is distinguished by exquisite sensibility and a sense of formal balance that results in performances of completely satisfying proportions, all phrased with the utmost elegance. He is at his best in French music and the type of compositions, many of them composed during the 1920s, Diaghileff used in his ballets. He conducted Diaghileff's ballet orchestras for many years and is suspected of having often influenced that impresario in his choice of composers.

Although he can approach and leave a climax as excitingly as any of his contemporaries, passionate readings are rare and sentimentality unheard of. This last attribute might explain why, despite the quite outstanding merits of his Scheherazade disc, I still have ever so slight a preference for the Beecham performance which made such a stir when it appeared among the earliest of the L.P.s.

This latter created astonishment and delight in its exploitation of stereo in combination with a reading as accomplished as Beecham's, Mechanically and artistically it was outstanding, and the sound can be enjoyed today without making any allowances for the period of its manufacture.

NEW VERSION BETTER

But good as it was, the engineering of Ansermet's new version is even better. It delivers its information with a sharpness of line and revelation of detail that make it a supreme example of the present-day sound-engineer's — and Decca's—technique at its best.

But it still fails to communicate the sensuous appeal of Beecham's performance though even the most critical listener could not accuse it of lack of warmth. The two readings are temperamentally different, and while Beecham's may appeal ever so slightly more to me, you may find the reverse to be the case.

However, another factor must be considered if you are contemplating making a choice between the two. The Beecham occupies the whole of a 12-inch disc, while the Ansermet includes as a bonus a first-class performance of the Polovtsian Dances. Personally, if confronted with selecting one of them for my library I'd feel like Macheath in "The Beggar's Opera" (I quote from memory): "How happy could I be with either, were t'other fair charmer away."

The Moussorgsky-Ravel "Pictures" has been issued so often in superlative sound that another might seem to many discophiles redundant. But here again, Decca goes one better than any of their predecessors, including their own earlier versions.

Details of Ravel's exquisite orchestration, imperceptible in the earlier version, can now be heard to astonish with their delicacy and charm. You hear more of the score here than you would in a live performance played anywhere but in a hall with perfect acoustics, listening with a score to enable your eye to aid your ear in appreciating Ravel's inexhaustible ingenuity.

As to the sound, you will hear the woodwinds in perfect balance with their colleagues and not brought up artificially close to the listener. And the soloists in this group — and all the others in the orchestra — play with a modest virtuosity that eschews primadonna tricks to attract more than their fair share of attention.

And here again Decca generously adds a bonus in the form of the Liszt tone-poem, Hunnenschlacht. The piece does not exemplify the composer at his best, indeed it has little but Ansermet's excellent performance to recommend it. And not even he can disguise the poverty of invention and mediocrity of the scoring.

ANCIENT BATTLE

Purporting to describe a battle for Rome between Attila's Huns and Christian Romans under the Emperor Theodoric, it scurries about like mad except for some sentimental chorale-like interjections from an organ. It may not affect you the same way, but this listener got the impression that in the battle sequences the troops seemed all to be running away from rather than toward each other.

But if you're looking for a new "Pictures," here is the one I can recommend.

The Mother Goose Suite also has a bonus, but this time a hidden one in the form of a Prelude and Spinning-Wheel Dance added by the composer to his original piano duet when his music was used for performance as a ballet in 1912. I know of no other version which includes these two delicious trifles. I found them utterly entrancing, the prelude quoting passages already well-known from the piano version, and the Spinning-Wheel Dance offering new material of quite dazzling rhythmical allure and delicacy of texture.

But in the Debussy Nocturnes the attributes of clear-headedness and concentration on clarity of line dissipates some of the composer's impressionistic haze in Nuages, where the clouds acquire hard edges, and in Sirenes, where the outlines are too clear to evoke an image of a magic island.

Moreover the women's voices, adding their wordless chant to the orchestra, not only fail to heighten the sense of mystery, but on the contrary go far toward destroying it by closeness to the mike that results in their contribution acquiring much too much importance in the general structure.

Fetes glitters brightly but with a cool light that one would not expect to find emitted by a southern European sun. In this you will find the same epicurean refinement you look for when Ansermet plays this type of music, but the air has been cleared of dust particles and there is little of the rough and tumble tactics of a crowd in festive mood.

But personally I would be prepared to accept a reading of the Nocturnes which didn't entirely satisfy me for two reasons. The shortcoming I have enumerated are not intrusive, and the Ravel Suite more than compensates for a slightly disappointing second side.

* * *

Shostakovitch — Piano Concerto No. 2, Op. 101. Ravel — Piano Concerto in G Major. Leonard Bernstein at the piano conducting the New York Philharmonic (Shostakovitch) and the Columbia Symphony Orchestra (Ravel). KLCS2746.

Bernstein's approach to Ravel differs considerably from Ansermet's. He concentrates much more on the emotional contents of the score. Thus he tends to linger a trifle too affectionately over the more lyrical passages, but there is no gainsaying his brilliance in the fast ones.

My meaning should become clear if you try as a sample his phrasing of the Gershwin-like second subject of the first movement of the Ravel concerto, and the long sentence with its Proustian relative clauses that opens the next. But here again your preference may well be for that type of treatment, and even those who agree with me will find much to admire and excite them in other parts of the work.

The sound is again admirably clear with an added richness of tone absent from the Ansermet discs. And Bernstein manages the whole performance from his piano stool, playing the solo part with outstanding brilliance while successfully attending to such matters as orchestral phrasing and problems of balance at the same time.

The general effect is technically so completely satisfactory that one is inclined to think all concerned know their parts well enough to play them in the dark.

The Shostakovitch Concerto is simple in structure, inventive in easily appreciated melodies, and has enough "fireworks" in the solo part to make it a rewarding experience for both performer and audience. It was created for performance by the composer's son while the latter was an advanced student of piano at the Moscow Conservatoire.

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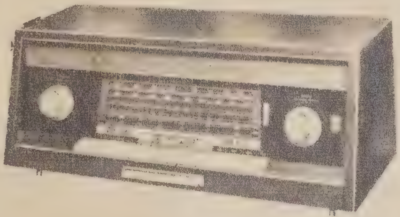

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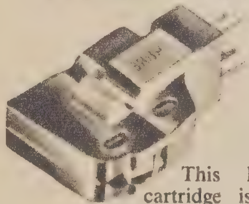

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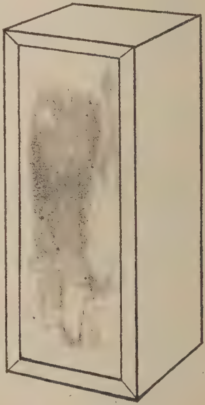

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It is all persuasively palatable, makes few demands on the listener's concentration, but is full of the most beguiling conceits. Bernstein again deploys his considerable technical accomplishments in a performance that is as enjoyable as anyone could desire.

As an alternative to the Ravel I suggest you listen to H.M.V.'s disc which uses Michangeli and the Philharmonia, conducted by Ettore Gracis with Rachmaninoff's Concerto No. 4 in G Minor on the reverse.

* * *

Brahms Symphony No. 3 in F Major, Op. 90. Columbia Symphony Orchestra conducted by Bruno Walter. Coronet Stereo. KLCS2754.

This to me is the best version available at present of the Third Symphony, despite ever so slight a hardness in the string tone. It has passion, elegance, and dramatic point that makes every bar a memorable experience.

To list its many virtues would produce only a tiresome string of superlatives. (How difficult it is to avoid them in reviewing a performance as good as this). All I can do is urge you to hear it. If you do you will buy it, whatever alternative version you might already own.

And this despite a reading of the St. Anthony Variations which falls short of providing the symphony's inspiring elation. For in the Variations Walter seems for once to show evidence of his great age. He is content to respond only passively most of the time to the composer's lyrical urging. His reading, if not the playing of the orchestra, lacks presence and impact.

There is nothing absolutely wrong in anything Walter does, but everything is pervaded by an autumnal mellowness that quite misses the ardour displayed in the symphony. It is far from dispirited, but Walter's most enthusiastic admirers could not call it exciting. It is rich in scholarship but reticent in expression.

* * *

Brahms — Symphony No. 4 in E Minor, Op. 98. Vienna Philharmonic Orchestra conducted by Rafael Kubelik. Decca Stereo, SXLA2206.

I should have been more enthusiastic about this stereo version of a mono which appeared some time ago, had Klemperer's incomparable performance not been issued in the meantime. The Kubelik has much to recommend it. It is well-considered yet avoids pedantry, warm without perfervour, and the sound reproduces the Vienna Philharmonic's string tone in all its glory.

The sound, too, is wholly admirable. Yet, to me, Klemperer's performance is at present peerless. He imbues the symphony with a grandeur that cannot be enjoyed elsewhere, and his peculiarly propulsive style is employed at its most effective. And strangely, I found Kubelik in this symphony much less enjoyable than in the other three, especially the second.

* * *

Chopin—The Six Polonaises. Malcuzynski (piano), Columbia Stereo SAX-2338.

Malcuzynski's playing of these patriotic outpourings is in the grand manner without depriving them of their essential lyricism. He maintains a full measure of control, both technical and emotional, over their most impassioned moments. And his readings have that "echt-Polish" ring that players of other nationalities never seem quite to impart to these ultra-nationalistic utterances.

He has to face stiff competition from Rubinstein's R.C.A. disc, though my preference, except in an occasional meditative phrase of Rubinstein's, inclines to this new set. For Malcuzynski never forgets that the polonaise is essentially a dance, stately in its ceremony, but with its massive pulse always there to keep the dancers tightly held in a formal pattern.

Not that you will find anything rigid or mechanical in his rhythms. His sense of a true Chopin rubato imparts plenty of flexibility into the composer's line. But he combines tragic symbolism with graceful movement in a manner I have still to hear matched in recent years.

And his technique enables him to overcome mechanical problems with almost casual ease.

You may find it necessary to cut back your highs a little to rid the piano tone of some slight sharpness, and perhaps I was unfortunate in getting a pressing with some prickles on its surface. But this last factor you can check for yourselves before buying, because otherwise I can recommend the disc with the greatest enthusiasm.

* * *

Chopin — The 14 Waltzes. Moura Lympany (piano). Columbia Mono 1349.

Many of these have the air of being run through briskly for the purpose of practice or memory-checking. Perhaps it is the engineering that gives the impression of missing notes in an occasional quick passage. At any rate the tone of the piano has no allure. It is unpleasantly nasal, with here and there a hint of wow, and even of distortion.

Much of Chopin's poetry is lost, but now and again Miss Lympany meets the composer's lyrical requirements. The slow A Minor (No. 3) is a case in point. But generally speaking I find little to recommend in this disc.

* * *

Brahms—Piano Sonata in F Minor. Intermezzo in E. Romance. Artur Rubinstein. RCA Mono L16296.

Rubinstein, I suppose, does all that is possible to make the eminently untidy first movement emerge as satisfactory structure. His failure to do so can be laid squarely at the feet of the composer. The various components have their moments of beauty, but not even Rubinstein can assemble them into a well-proportioned whole.

He meditates poetically over the slow movement and manages to infuse a Chopin-like grace into the Scherzo. The Finale, however, is never convincingly argued. Except in the second movement, which is mostly in the form of a quiet soliloquy, the piano tone is a little on the dry side and no adjustment I could make to my set improved it.

But I can recommend without qualification Rubinstein's playing of the two small pieces used to fill the second side. I doubt if you will hear these played better for a long time.

* * *

Tchaikowsky—Symphony No. 5 in E Minor, Op. 61. London Symphony Orchestra conducted by Sir Malcolm Sargent. Everest Stereo SEC-930,074.

(Continued on Page 107)

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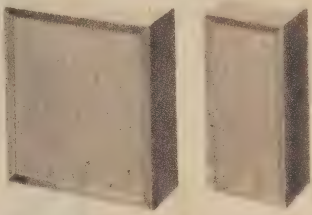

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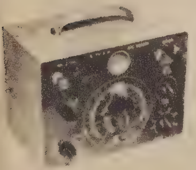

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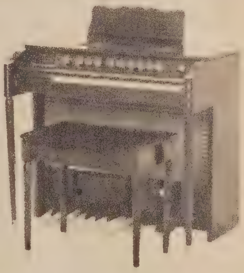

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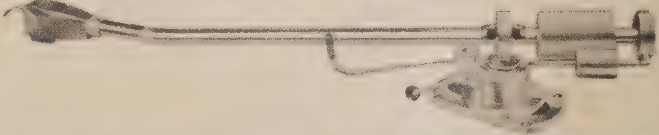

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Sargent figures here in an unusual role. As a rule he can be expected to give a spirited account of whatever he plays. In this reading he tends towards reticence.

He gives the impression during much of the work of deliberately playing it down to avoid any hint of perfervour. When he does apply emotional pressure the effect suggests excitability rather than intensity. Many of his tempos are ever so slightly held back, an effect you can sample by running through a few bars of the waltz movement.

The Finale, too, goes at a very deliberate pace, though Sargent manages to imbue it with enough weight to make it forceful. True, whenever he comes to a purples patch, Sargent lets himself, and his orchestra, go and offers some exciting concluding bars to the various movements. Otherwise the performance is largely uneventful.

Sonically the disc has a wide dynamic range which doesn't coarsen in tone in even the weightiest passages. The horn solo in the slow movement sounds unaccountably remote, and a very awkward turn-over will spoil the enjoyment of this section of the work for many.

The orchestral playing is good though not quite up to the high standard of the improved LSO of recent months. I think something more attractive is certain to turn up in the near future.

* * *

Berlioz — Overtures. Roman Carnival; Beatrice and Benedict; The Corsair; Benvenuto Cellini. Royal Hunt and Storm from The Trojans. Boston Symphony Orchestra conducted by Charles Munch. RCA Mono L16294.

I can recommend this disc to those who want first rate performances of these attractive works. Munch has just the right touch for Berlioz, maintaining admirable clarity of the composer's "classical" line yet giving full weight to his romantic extravagances. Moreover each item has its own sparkling vitality to be enjoyed however well you may know it.

The sound is good though some monitoring of the timpani here and there would have placed those assertive instruments in better perspective with their colleagues' in other departments. A very handy disc to have by you for dipping into from time to time.

* * *

Beethoven—Piano Concerto No. 5 in E Flat (Emperor) Op. 73. Van Cliburn and the Chicago Symphony Orchestra conducted by Fritz Reiner. RCA Stereo SL16297.

Van Cliburn will have to tone down his present extroverted style before he can give us a persuasively argued account of a work such as this. Yet he does enough of the right things in his performance to promise better when he sheds some of his youthful ebullience.

The Adagio, for instance, is thoroughly enjoyable in every bar, and elsewhere in the quieter reaches of the score he displays moments of poetic insight. He is at his least successful where he substitutes loudness for forceful thinking and finishes by interposing too much of himself between the music and listener.

It is not difficult to understand Reiner's problems in supplying an orchestral part to such a solo. He is too fine a musician not to find some sort of compromise, however widely he might differ in his views on the concerto's performance. As a result, he follows Cliburn's moods very carefully indeed whenever the piano takes the lead, but offers very different Beethoven in those passages where the orchestra can speak for itself.

These two different points of view are most conspicuously exemplified in the final Rondo where subtle differences of rhythm between the two reveals Cliburn's immaturity. The piano tone is a little on the light side but otherwise the sound is good and the balance between piano and orchestra nicely adjusted.

* * *

Brahms—Piano Concerto No. 1 in D Minor. Op. 15. Claudio Arrau and the Philharmonia Orchestra conducted by Carlo Maria Giulini.

This disc does not exhibit anyone concerned with its production in their best form. Columbia's sound is often muddy except when the woodwind, placed abnormally close to the listener, overbalances the rest of the orchestra.

No effort was apparently made to thin out the middle section of the orchestra in a manner to increase the transparency of the scoring. The result is a real old-fashioned Brahms potage.

Here and there you will find some arresting passage delivered by both orchestra and soloist. Not unexpectedly, Arrau has his moments of exalted lyricism and his technique is never in question. But his is far from a great performance, at any rate, here.

RECOMMENDED

Beethoven—Quartet No. 9 in C Major, Op. 59, No. 3 (Rasoumovsky).

Beethoven—Quartet No. 11 in F Minor. Op. 95 (Serioso). Coronet Stereo KLCS2750. Mono KLC2750.

Beethoven—String Quartet No. 10 in E Flat Major, Op. 74 (Harp). Budapest String Quartet. Coronet Stereo KLCS2751. Mono KLC2751.

Rimsky-Korsakoff—Scheherazade. Symphonic Suite, Op. 35. The Philharmonia Orchestra conducted by Paul Kletzki. HMV Concert Classic Mono OXLP20026.

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RADIO FREQUENCY ALLOCATIONS

Australian amateurs have been anxiously awaiting, for many months, the results of the deliberations of the Radio Frequency Allocation Review Committee. Their recommendations, tabled in Federal Parliament in October, were generally well received.

FOLLOWING the announcement by the Postmaster-General in the House of Representatives on Friday, October 13, covering the frequency allocations for Radio Amateurs as recommended by the Radio Frequency Allocations Review Committee, most amateurs heard the details over the following Sunday WIA Broadcasts. The recommendations of the R.F.A.R.C. carried some changes over the original Geneva proposals for Australian Radio Amateurs.

It is some two years since the late John Moyle, VK2JU, left for Geneva to represent the W.I.A. and the Australian Amateur at the I.T.U. conference. His return and subsequent action was clearly brought to mind, when on October 18, VK2WI replayed four tapes covering the conference and reports of progress. The tapes comprised John VK2JU's report on Geneva and three recorded by the Federal President, Max Hull, VK3ZS, at various stages of the I.T.U. conference and negotiations.

The final report of the R.F.A.R.C. as tabled certainly showed justification for the action taken by the W.I.A. and individual amateurs in forcing the airing of their displeasure at the original Geneva proposals. To our good friends both in and outside Parliament our thanks must be extended.

In general, amateurs can be well pleased with the allocations as tabled, the only serious loss being 100 Kc/s from the 3.5 Mc/s band. The retention of the 50 Kc/s at 7 Mc/s, although shared with SW B/C stations, will be a great asset, as this band is the most important for inter and intrastate working. The stabilising of the 50 and 144 Mc/s bands in line with International allocations is also a forward step. The gain of 60 Kc/s at 1.8 Mc/s will provide a band of value for local and emergency operation; it should be very popular in the winter season.

It has been a long wait, most countries having been operating on their Geneva allocations since June of this year. The ultimate outcome of the investigation is certainly pleasing and justified the W.I.A. in sponsoring VK2JU's journey to Geneva. It has created a pattern for future action and the absolute necessity of representation at such level to ensure that the amateur service receives just recognition.

The following are the bands listed for amateur operation. Some are on a shared basis:—

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A number of other recommendations in the 90-page report can also have important bearing on the Amateur Service and their full import will undoubtedly be reviewed in "Amateur Radio."

The officials and members of the Wireless Institute of Australia should receive full credit for financing John's trip to Geneva. They were wise too in selecting such an able delegate and in their subsequent concerted action in making sure the amateur's position was made clear, in view of the drastic cuts proposed in the original Geneva allocations.

MEMORIAL VHF CONTEST

THE W.I.A.'s Ross Hull Memorial VHF contest for 1961-62 will be conducted during December and January and is the only VHF contest event conducted on an Australia-wide basis. It is held in memory of the late Ross Hull who did much to advance the VHF art. A perpetual trophy is awarded annually for competition between members of the W.I.A. in Australia and its territories.

The following is a summary of the rules of the contest, which runs from 0001 EAST on 16/12/61 to 2359 EAST on 14/1/61.

The contest is divided into three sections:

(a) Transmitting open 50 Mc/s and higher.
(b) Transmitting phone 50 Mc/s and higher.
(c) Receiving open 50 Mc/s and higher.

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All VHF bands may be used but crossband working is not permitted, except that 50-54 and 56-60 Mc/s may be considered as the same band.

Only one contact per band per station is allowed each calendar day.

Cyphers: Before points are claimed for a contact serial numbers must be exchanged. RS (phone) or RST (CW) plus three figures commencing from 001 for the first contact will be the serial number.

Entries must be post-marked not later than 14/2/62 and should be addressed to the Federal Contest Committee, Box 851 J, Hobart, Tasmania.

Logs forwarded should be drawn up on the usual forms and include an additional column showing distance of contact. The usual declaration and cover sheet should also be included.

Scoring is based on the attached table. Contestants will have to agree between themselves on the distance between their stations.

Awards: Certificates will be awarded to the winner of each section in each VK and overseas call area. The VK winner who returns the highest score in the transmitting sections and who is a financial member of the W.I.A. will hold the trophy until the next Ross Hull contest is decided and, in addition, will receive an appropriately inscribed photograph of the trophy.

A new method of scoring has been evolved from suggestions made by the majority of VK divisions and comments are invited from amateurs on how they find this new arrangement operates. The points awarded vary with distance over the various VHF bands and allowances are made for distance paths that can readily be covered.

The following scale is the scale for the 50-54, 56-60 and 144 Mc/s bands and varied figures are applicable to other bands:—

	50-54 56-60 Mcs	144 Mcs
Distances	Points	Points
Up to 10 miles	1	1
10 to 25 miles	1	1
25 to 50 miles	1	1
50 to 100 miles	4	2
100 to 200 miles	10	4
200 to 300 miles	20	10
300 to 500 miles	10	16
500 to 1,000 miles	2	30
1,000 to 5,000 miles	10	40
Greater than 5,000 miles	20	50

SCOUT JAMBOREE

EXTENSIVE support was afforded the Boy Scouts Jamboree-on-the-Air by Australian Amateurs. Individual amateurs in all parts of the Commonwealth provided Boy Scouts with an opportunity to become acquainted with Amateur Radio, either at their home station or by setting up equipment at the local Scout Hall. In some areas groups of amateurs banded together to provide the most effective coverage for the Scout Troops. The Jamboree was sponsored by the various National Amateur Radio Societies and the W.I.A. afforded full support. Held over the weekend October 21 and 22, main activity was noted on Saturday afternoon when the 7MC/s band was reminscent of the crowding during an RD Contest. Unfortunately in N.S.W. conditions were very poor and reception was not assisted

Wireless Institute of Australia
Victorian Division
A.O.C.P. CLASS
commences
Thursday, 9th November, 1961

Theory is held on Monday evenings and Morse and Regulations on Thursday evenings from 8 to 10 p.m.

Persons desirous of being enrolled, should communicate with—

Secretary W.I.A., Victorian Division,
P.O. Box 36, East Melbourne.
(Phone: 67-3084, 10 a.m. to 3 p.m.)
Or the Class Manager on either of the above evenings.

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Radio and Electrical Distributors,
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Phone MA1876. Open Saturday Mornings.

First Licence For School Club Member

SCHOOL Radio Clubs are playing an important part in introducing pupils to amateur radio. Many such clubs are in operation in secondary schools throughout Australia and provide school members with an opportunity to learn something of the "mystery" of electronics. Their aim is to promote interest in the theory and practice of electronics and already one school club member has obtained his full A.O.C.P. licence.

The first school radio club member to obtain his full amateur licence has recently been allocated his call sign. He is Ian Forrest, a member of the Booragul High School Radio Club and now VK2AJF. Ian, who has been interested in radio since he was 12 is at present a fifth-year pupil at Booragul. Because of the final examinations which are drawing near, Ian finds it difficult to get on the bands but he is hoping to make up for this when the Leaving Certificate is over. The photograph shows Ian with the school's transmitter, VK2ATZ, which he designed and constructed. The transmitter runs about 15 watts and is crystal controlled. The remainder of the gear is ex-disposals, some of its loaned from the W.I.A. The club may be heard on the 40-metre band during the week at lunch-times and on Wednesday and Friday afternoons around 4 p.m. The club has 15 other members, many of whom are anxious to obtain their licences. Ian says that it should not be difficult for any senior pupil to pass the exam provided he keeps at it. None of the club members at Booragul is more than 17.

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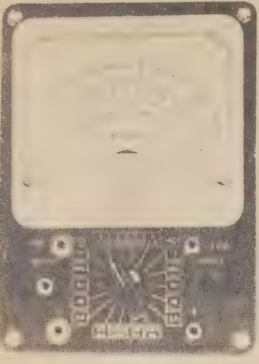

MODEL RH-955

MODEL RH-955

SPECIFICATIONS

* **Sensitivity:**
50,000 ohms per volt DC
5,000 ohms per volt AC
* **6 Ranges:**
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AC voltage: 0-2.5-10-50-250-1000 volts.
DC current: 0-100uA, 0-10-100-500mA, 10 Amps. (all at 250mV)
Resistance:

Ranges	Centre scale
0-20,000 ohms	200 ohms
0-0.2 megs.	2,000 ohms
0-2 megs.	20,000 ohms
0-20 megs.	0.2 megs

Decibels: —20 + 46.
db 5 ranges (0 db 1mW into 600 ohms)
* **Dimensions:** 7in x 5¼in x 3in.
With Plastic Pouch Test Lead Kit.
* **Meter sensitivity:** 20uA

PRICE £23/16/-
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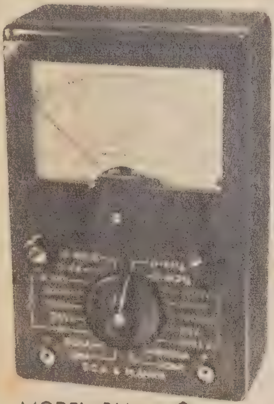

MODEL RH-31

MODEL RH-31

- * 20,000 Ohms per Volt on DC
- * 10,000 Ohms per Volt on AC
- * 3½" Meter
- * 18 position selector

SPECIFICATIONS

DC Voltages: 0-5-25-100-500-1000-5000 (20,000 Ohms/V)
AC Voltages: 0-5-25-100-500-1000V (10,000 Ohms/Volt)
DC Current: 0-50 uA, 0-5-50-500mA
Resistance: 0-6K-600K, 0-6Meg-60Meg (30 Ohms, 3K, 30K, 440K at centre scale)
Capacitance: 100uuF--0.01uF, 0.002uF-0.3uF
Inductance: 20 H to 2000 H
Decibels: minus 20db to plus 30db in 2 ranges
Output Jack: for Audio measurements
Dimensions: (3¾" x 5¾" x 2 3-8")
Weight: (23oz approx.)
Complete with internal battery and testing leads with prods.

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Modern Design, 33 Micro Amp Meter.
30,000 Ohms per Volt D.C.
13,000 Ohms per Volt A.C.
1 p.c. Multipliers and Shunts used.
Printed circuit.
Clear Scale, rugged moulded case.

SPECIFICATIONS

DC Voltages: 0-0.3-1.2-3-12-30-120-300-600-1,200 V at 30,000 ohms per volt.
AC Voltages: 0-3-12-30-120-300-600-1,200 V at 13,000 ohms per volt.
DC Currents: 0.06-6-60-600 mA, 0-12 A.
Resistance: 0-60K-6M-60M (350, 35K, 350K at mid-scale).
Decibels: −20 to + 57 db (0 db = 1 mW, 600 ohms).
Audio Out: Capacitor in series with AC volt ranges.
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Accessory: 1 pair heavy test leads.
Batteries: 1 (1.5V), 1 (15V).
Size: 3 5-16in x 6 5-16in x 2¾in.
Weight: 1.4lb approx.

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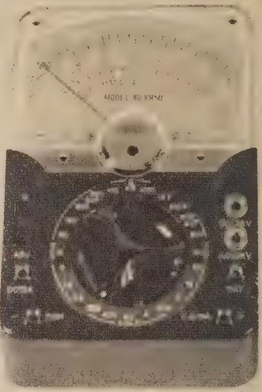

MODEL RH50

MODEL RH-5

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- * 3" Meter
- * Handy pocketable size

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AC Voltages: 0-10-50-250-500-1000V (10,000 Ohms/V)
DC Current: 0-50uA, 0-5-50-500mA
Resistance: 0-10K, 0-100K, 0-1Meg, 0-10 Meg
(62 Ohms, 620 Ohms, 6.2K, 62K at centre scale)
Capacitance: 0.0001uF-0.005uF
0.005uF-0.1uF
Decibels: minus 20db to plus 36db in 2 ranges
Dimensions: (3½" x 5¼" x 1¾")
Weight: (15oz approx.)
Complete with internal battery, testing leads with prods.

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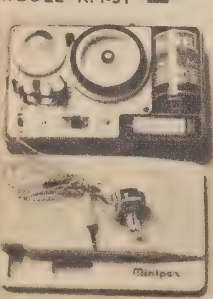
MODEL RH-5



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by the heavy QRN provided by widespread thunderstorms.

The Scouts showed plenty of enthusiasm and the whole operation should prove of value to both the Scout Movement and Amateur Radio.

83-ELEMENT BEAM

VK4ZAX is erecting an 83 element beam for 144 MC/s and together with a SSB transmitter should be in serious business by the end of November.

The JA's are still being worked on 50 MC/s in parts of Queensland and VK4XJ contacted both VK9 and JA on 22.10.61. Weak JA signals were heard in Melbourne during October.

Serious attention is being paid to the possibility of a VK3/VK6 contact on 144 MC/s. A number of stations will be active on this project during the forthcoming season.

VALE JACK PIKE

N.S.W. lost one of its best known and liked old timers with the passing to the ranks of silent keys of Jack Pike, VK2JP. His death occurred on October 17 aged 71. The sympathy of all amateurs is extended to his wife and family in their bereavement. Jack who had been a radio amateur for just on half a century attended the inaugural meeting of the WIA in N.S.W. held in 1911 and was one of the signatories when the Division was incorporated in 1926.

He was a life member of the N.S.W. Division. VK2JP became a callsign well known to amateurs throughout the world as, since the 1930's he had operated practically exclusively on the 14 MC/s band, mainly on telephony. Jack was well to the fore in the 1920's when the short wave spectrum was being opened by Radio Amateurs, making some of the first international contacts. Retired for just on six years, he spent much of his time with his hobby and his ready quips and wealth of information on the Amateur Service provided many an amateur with an instructive contact. Jack will be missed from the ranks.

WIA ACTIVITIES

BOB LUTHER VK2ZEL resigned from the position of Secretary of the N.S.W. Division in October due to ill health. Amateurs wish Bob a speedy recovery. The new secretary is Bill Storer VK2EG of Antarctica VK1EG fame and Bill is already busy taking over. Secretaries jobs are generally the most thankless in any voluntary society, plenty of work reflecting on other normal activity and often plenty of reaction from other members of the family.

Keith Jeffcoat, VK2BK, lectured to the N.S.W. Division's SWL Section in October. Keith covered improving receiver performance on the short waves. He provided a practical demonstration with suitable test equipment of lining up procedure.

The Hunter Branch of the N.S.W. Division are now conducting 144 MC/s Fox Hunts as monthly events. The first of them resulted in a win for Ian, XK2ZIF. The foxes for the occasion were Stuart, VK2AYF, and Lionel, VK2CS.

SUNSPOT DECLINE

THE current sunspot cycle (19) continues to decline at a rapid rate. The smoothed sunspot numbers are generally running about 10 per cent below the forecast figures. There is plenty of support being expressed for the observations on the low figures that can be expected for the next three sunspot cycles. John H. Nelson, propagation expert for R.C.A. Communications Inc. predicts the following pattern similar to the previous prognostications.

The next three sunspot maxima will be very much lower than the past three maxima.

The maximum of the next cycle (20) should be in the order of 60 to 70 (about the figure experienced in Aug.-Sept. 1961) on the 12 month running smoothed sunspot scale, followed by a slow decline with very low numbers.

The maximum of cycle 21 should be in the order of 40 to 50 with a very slow decline with very low numbers.

The maximum of cycle 22 should be in the order of 45 to 55 with a moderate decline with low numbers.

The period from the present until the beginning of the next cycle will also show a slow decline with only moderate to low numbers. According to reports there are still some propagation experts that do not believe the cycles 20, 21 and 22 will produce figures as low as predicted—let us hope they are correct.

AIR CHARTERS

A NEW departure in Amateur activity is scheduled for 1962 with international charter air flights so that amateurs can attend conferences on other continents. The first is listed for March when G3NUY and G3KGC are planning a Trans-Atlantic flight so that G-land SSB enthusiasts can attend the annual SSB Association's dinner in New York. This year's SSB dinner attracted over 1,000 amateurs including representatives from 12 DX countries. The dinner coincides with the IRE's convention and exhibition, so there will be plenty to interest the radio man. The other charter flights are being arranged by Ralph PY2QT who plans two, one from Europe, and one from the U.S. They will allow amateurs to attend the International Radio Conference to be held in August, 1962, in Brazil.

PROJECT OSCAR

ONE of the most impressive documents yet presented on the work of the Radio Amateur is the "White Paper" issued by the Project Oscar Association in support of their "Orbital Satellite-Carry Amateur Radio." The paper was printed in its entirety in August "C.Q." and described the satellite project in simple terms, its aim and purpose. The document covers the objects of the association and states how the world's 300,000 amateurs could constitute the most extensive listening, tracking and data handling communications network that could ever be assembled. The technical contributions of the amateur to the art over the years are covered. The paper should b read by every serious-minded amateur.

OPERATING PRACTICES

OPERATING practices by amateurs are always the subject of discussions on the air and in amateur radio journals. Everyone has their own pet ideas on how practices should be varied to improve relations on the bands. Contests have been the subject of much debate in recent months. Most weekends (every weekend from August through mid-December) seem to se esome contest listed and conducted by some group in some part of the world. Such events have their supporters and critics. In actual fact few of these contests affect the operation of Australian amateurs for, fortunately, we are isolated to some degree. However, in Europe, according to reports, interference runs high at times over many weekends

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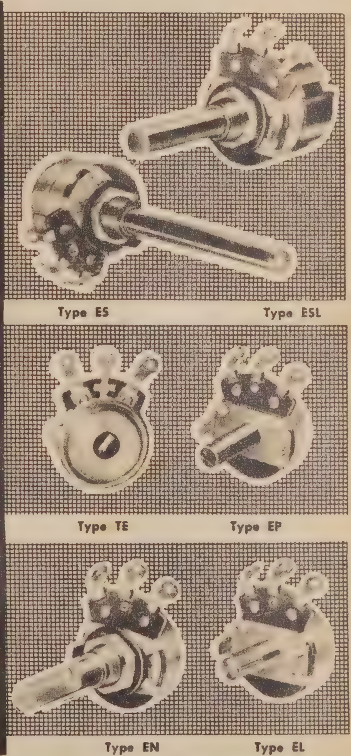

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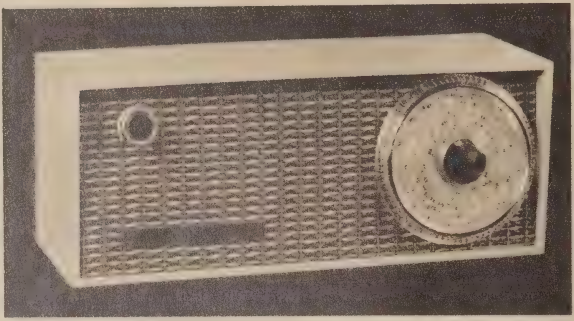

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to non-competitors. Contests, with a few exceptions, are not as well supported as some years ago. However, they form an accepted phase of amateur activity of interest to some mebers of the service and they are fully entitled to enjoy them.

SUPPORT FOR RTTY

SINCE early 1959 when RTTY was first introduced in the U.K. the mode has gained many supporters. Over 100 stations are now on the air and the 80-metre band is the main centre of operation. The 144Mc/s band is also used extensively. Contacts are made regularly with Continental stations. The main problem from the amateurs' viewpoint is the acquiring of a teleprinter, a complicated and normally costly piece of equipment. Fortunately in recent years Creed Type 3 or Type 7 machines have been available for as low a price as £5. RTTY has a number of advantages as a system of communication, high speed of sending, narrow bandwidth and freedom from some types of QRM. RTTY operation has been popular in the U.S. over many years and RTTY forums at amateur conventions often draw over 100 interested amateurs. Teleprinters are available from surplus stocks, also from Teletype societies, who make machines available to interested amateurs. Latests polls show that about 1.5 per cent of U.S. amateurs use RTTY and this means about 3,000 of them see their QSO's on paper.

RTTY amateurs conduct their own contests and a world-wide sweepstakes was conducted over the weekend of October 21 and 22.

"GENTLEMAN" FINED

ALTHOUGH the intruder who was jamming WIA official broadcasts for a period has not appeared for some months it is interesting to note his counterpart in the U.K. was recently reprimanded. The gentleman (?) was caught jamming the RSGB news bulletins, he was fined £75 and costs for causing deliberate interference in contravention of the Wireless Telegraphy Act.

AFRICAN CALL SIGNS

IT is not anticipated that there will be any immediate changes in amateur callsign prefixes in South Africa according to their Post Office. The prefixes in use will stand for the time being and early warning will be given of any variation. The African Continent, with the formation of so many new republics, has seen many new prefixes in the last 12 months. It is quite difficult to keep conversant with the many prefix additions and changes.

PROBLEMS IN ARCTIC

LEE WILTS recently told of his experiences operating amateur stations over a number of years in the Arctic. The main problems naturally were concerned with antennas. Lee said a ½ inch diameter conductor would build up to 6 inches diameter with ice in a matter of days. He worked consistently on his 10 and 20-metre arrays after any storm and finally abandoned the larger beam as the damage became too extensive. Co-axial cable lasted well under exposure but one had to be careful not to bend it as it would readily snap.

CARD ENDORSEMENTS

THE correct endorsement of the type of contact made between radio amateurs should show on all QSL cards. This is very necessary if the recipient is to use them in claiming any operating award. There are a number of awards offering these days that require contacts using particular transmitting modes. Two-way SSB working is a case in point and cards supplied for such QSO's must be clearly marked two-way SSB. A little thought when writing out a card can often assist the overseas amateur in his quest for certificates.

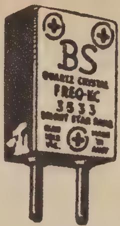
REMEMBRANCE DAY CONTEST

THIS year's contest was won by Western Australia with a State score of 3,805 points over South Australia's 3,529 points and Tasmania's 3,221 points. We understand that a lot of organising went into contest preparations in W.A., and the results prove that the effort certainly was worth it. An interesting sidelight is that, this year, VK2 beat VK3 into fourth place. The bands were well populated during the contest, but it is a pity that some States still have a participation factor of less than 10 per cent.

The highest State log average was from South Australia with 222 points while the highest individual score came from VK5NO who tallied 1,389 points—congratulations OM. Space does not permit us to list all the individual scores, but the top six in each State are as follows: N.S.W.: VK's 2AHM, 2AHH, 1PM, 2ASZ, 2DO, 2BO. Vic.: VK's 3ALZ, 3ADW, 3AIT, 3DF, 3APJ, 3UW. Queensland: VK's 4DP, 4RH, 4UX, 4TM, 4BQ, 4PS. South Australia: VK's 5NO, 5WO, 5FT, 5ZK, 5TC, 5MS. Western Australia: VK's 6RU, 6KW, 6CL, 6AR, 6AD, 6SM. Tasmania: VK's 7MS, 7AI, 7SF, 7RL, 7SM, 7MZ.

After all these years it becomes obvious that the larger States will never get the required number of log entries to win the contest. Several suggestions for changes in the rules and in the scoring system have been submitted with this year's logs, and next year the W.I.A. may try something new. The federal contest committee will study the possibilities of any suggestion sent in, and in due course submit the most promising to Federal Executive and to the divisions for consideration. If you have any ideas, let's hear them.

BRIGHT STAR CRYSTALS



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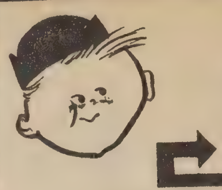

GIFTS TO KEEP JUNIOR *QUIET*

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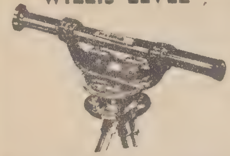

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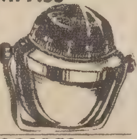
Now the best and cheapest available. Has blued lens and windage and elevation adjustment. Supplied with clamps. £6/15/. (Post 4/6.)

R.A.A.F. SPOTLIGHT

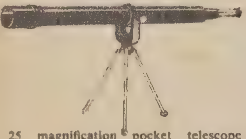
The only good spotlight available under £2. Works off 12 volts and is ideal for shooting or for car or boat. 39/6. (5/ Delivery to Rail.)

NAVIGATIONAL COMPASS



Suitable for any small craft. Double chromed for rust protection. Liquid damped and gimbal mounted for maximum efficiency. £4/19/6.
(Post 4/6.)

TELESCOPES



25 magnification pocket telescope which slips neatly into a pigskin case. Excellent gift for tourists, etc. £3/19/6. (Post 4/6.)
RANGE TELESCOPE. Supplies 40 magnifications, complete with tripod. £8/19/6.
POWER TELESCOPE. Supplies 50 magnifications, excellent lookout telescope. £9/19/6. (Post 8/6.)

FUSEMASTER

Screwdriver with three gauges of fuse wire wound inside a screw-off handle. Keep near the fuse box for emergency blackouts. 3/9. (Post 1/.)

TOMAHAWKS

With non - slip rubber handle. 18/6. (Post 4/6.)

STEEL RULES

6-inch stainless steel rule with clip for pocket, 2/. 12-inch folding, 3/6. (Post 1/.)

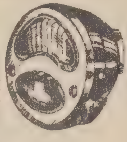
SPANNER SETS

Ring Spanners, S.A.E. (6-piece set), 57/6. Metric (5-piece), 52/6. (Post 2/6.)

ARMY AMMO BOXES

Make excellent tool boxes for car or workshop. Very sturdy, with double hinged lid and leather carrying straps. 12/6. (5/ Delivery to Rail.)

STOP & TAIL LIGHT



Red tail-light, ideal for car, trailer, caravan, etc. Beautifully finished in chrome and black and available in 6 or 12 volt. 14/6. (Post 3/.)

NEON TESTER

Checks voltages up to 230 AC. Clips inside the pocket like a fountain pen. 6/6. (Post, 1/.)

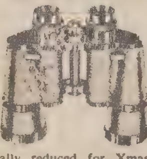
SPARK PLUG TESTER

Checks existence and density of spark. Clips inside the pocket like a fountain pen. 5/9. (Post 1/-.)

CAR COMPASS

Fits simply to the dashboard or windscreen with a suction cup. Oil damped and compensatable. 49/6. (Post 2.6.)

BINOCULARS



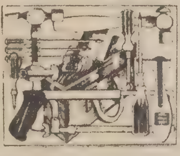
Specially reduced for Xmas gifts. Look! All these popular models at the one price. 7 x 50, 10 x 50, 12 x 50, 16 x 50, £14/17/6.

Also 20 x 50 Racing Commentator's Binoculars, £17/19/6. All binoculars come in beautiful pigskin cases. (Post 8/6.)

MONOCULARS

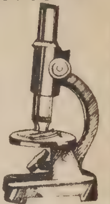
Also an excellent gift. Ideal for races, boating, football, etc. 8 x 30, £5/19/6. 7 x 50, £8/15/-. (Post 5/6.)

AUTO TOOL KIT



Specially compiled by Walthams for home car maintenance. Army "Ammo" tool-box, set of feeler-gauges. Three new screwdrivers, one Phillips screwdriver, one general screwdriver, two engineers' hammers, hacksaw. Set of open-end spanners (Metric, Whitworth or S.A.E.), King Dick shifting spanner, spark plug tester, pocket tyre gauge. All for £4/5/. (5/ Delivery to Rail.)

NEW MICROSCOPES



JUNIOR STUDENTS MODEL

150 magnifications. A superb gift, both educational and entertaining, for your child. Only 22/6. (Post, 4/6.)

JUNIOR MICROSCOPE KIT

Contains triple turret microscope, 300 magnification, scissors, mag. glass and several other instruments in a neat box. 39/6.

INTERMEDIATE MODEL

Single lens, triple turret microscope, 300 magnifications, £2/15/-.

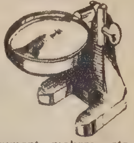
SENIOR MODEL

Super twin lens model with built-in lighting for night use. Comes in a wooden gift case, £6/19/6.
(All Post, 8/6 reg.)

POCKET MICROSCOPE

Supplies 50 magnifications, ideal for geologists, stamp and coin collectors, etc. Clips into the pocket like a fountain-pen, 15/9. (Post, 1/6.)

MAGNIFYING GLASSES



NEW! Round glasses on stand enable you to work with both hands free. Ideal for artists, photo-retouching, instrument makers, etc. 17/6. NEW! 20 magnification glass, most powerful on the market. Suitable for geology, stamp and coin comparison, etc. 25/. (Post 2/6.)

REAL HUNTING KNIVES

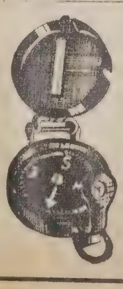
Yes, real "Bowie" type knives in a leather sheath. Suitable for fishing, skinning, etc. 12/6. (Post 2/.)

SCOUTS' KNIVES

With hook for belt and two blades. 12/6. (Post 2/.)

MAKE YOUR OWN FISHING ROD

Three copper-coated steel sections screw together to total 12 feet. Very strong and springy. Excellent for fishing. 22/6. (5/ Delivery to Rail.)



LENSATIC COMPASS

A very accurate sighting compass with built - in scale magnifier. Excellent hiker's compass. 22/6.
(Post, 2/6.)

POCKET COMPASS

Map reading compass. 12/6. Pocket compass with fold-down lid. 7/6. (Post 1/.)

OIL FILLED WRIST COMPASS

Straps on to the wrist like a watch. Impossible to lose even in dense scrub. Oil damped for utmost accuracy. 22/6. (Post., 1/6.)

MINIATURE MOTORS

For driving model trains, cars, etc. Work off 1½-volt batteries. No. 45, 8/6; and No. 55, 10/6. (Post 1/6.)

HOBBY KITS

Assemble yourself kits, model bell and motor. 5/6 each. (Post 1/.)

MINIATURE OUTBOARD MOTORS

Replicas of real outboard motors. Clamp to the stern of your model boats and watch 'em go. 19/6. (Post 1/6.)

WRIST COMPASS

12/6. (Post 1/6)

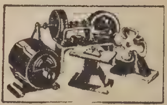
INTER COMM. SETS

Special room-to-room listening set. Ideal for boys and girls. Contains two new headphones, microphones and matching transformers. 33/9. (Post 4/6.)

BRAND NEW CRYSTAL SETS READY FOR USE

Complete in attractive little cabinet, £1/19/6. EARPIECE, 7/11 extra, or headphones, 27/6 extra. (Post 3/6.)

MINIATURE WORKSHOP



Battery-driven, 3-volt motor operates 4 miniature engineering tools. There's a power saw, a line shaft, a fan and a circular saw. 17/6. (Post 3/.)

MORSE KEY & BUZZER

Ex-Army Morse key with high-pitched buzzer makes ideal practice set for just 12/6. (Post 3/6.)

JEWELLERS' EYEGLASS

Suitable for all hobbies, single lens supplies 7½ magnifications. 10/6. (Post 1/.)

GOING FISHING! NEED WORMS! THEN BUY A WORM HARVESTER

Yes, it's true. With one of these you can harvest all the worms you need without the tiresome digging. 10/6. (Post 5/.)

WALTHAM TRADING CO.

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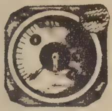
GIFTS TO MAKE HOBBYISTS *HAPPY*

BUILD YOUR OWN REV. COUNTER



Yes, as suggested in February, March, 1960, issues of "Radio, TV and Hobbies," you can build your own tachometer from these radio altimeters. Only **37/6** ea. (Post 3/6.)

RECORDING TAPE

1,200 feet of twin-sided tape on standard 7in plastic spools. **29/6.** (Post 3/6.)

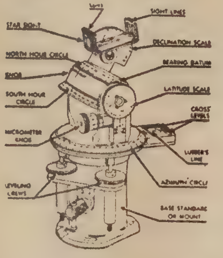
TAPE SPOOLS

3in, **3/3;** 5¾in, **5/6;** 7in, **5/11.** 3,000 feet commercial spool, **7/6.** (Post 1/6.)

MUSIC BOX MOVEMENTS

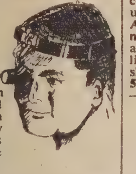
Fit these beautiful movements to your own box. Makes a lovely Xmas gift for somebody. THE BLUE DANUBE, SANTA LUCIA, LIMELIGHT, THE HARRY LIME THEME, LILI MARLENE, ANNIVERSARY SONG, **30/** ea. (Post 1/6.)

ASTRO COMPASS



R.A.A.F. instrument, can be used for obtaining direction from sun or stars. It can be adapted for astronomical study and for finding exact positions. A free tripod is supplied with each compass, which will fit the compass after minor adjustments. **59/6.** (Post 8/6.)

Jewellers' EYEGLASS ON HEADBAND



Work in comfort on your repairs and hobbies with both hands completely free. Headband is adjustable in size and positioning. **18/6.** (Post 2/6.)

DASHBOARD MAP LAMP

Handy auxiliary lamps to fit to the dashboard to read maps, etc. Only **5/6** ea. (Post 1/.)

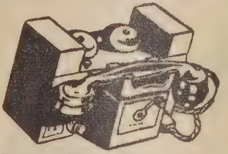
ELECTRIC SOLDERING IRONS

Brand new electric soldering irons, work off 240-volt household supply. 60-watt, **48/6;** 80-watt, **52/6;** 130-watt, **64/6.** (Post 2/6.)

MULTI-PURPOSE WIRE

3,000 feet of soft plastic-covered wire on a wooden reel. Ideal for all gardening uses in place of rope. **7/6** per reel. (5/ delivery to rail.)

FIELD TELEPHONES



Ex-Army field telephones, ideal for shop to store communication. Far cheaper than normal P.M.G. extensions and no yearly rentals either. **£4/9/6** (5/ delivery to rail)

8-0-8 AMMETER

Suitable meter for battery-chargers, motor scooters, etc. Very cheap at **12/9** ea. (Post 2/.)

30-0-30 AMMETER

Ideal panel meter for your car dashboard. **17/6.** (Post 2/.)

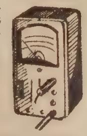
0-1 MILLIAMP METER

1in 0 to 1 milliamp panel meter at lowest ever price. **29/6.** (Post 2/.)

Magnetic EARPIECE

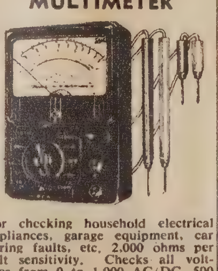
Low ohmage, suitable for most transistor radios and tape recorders. **10/.** (Post 1/.)

Pocket MULTIMETER



Very tiny multimeter which slips easily into a man's coat pocket. Reads up to 1,000 volts AC/DC and 150 milliamps and ohmage. Every travelling repairman should have one, **55/.** (Post 4/6.)

SUPER SANWA MULTIMETER

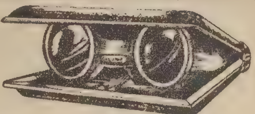


For checking household electrical appliances, garage equipment, car wiring faults, etc, 2,000 ohms per volt sensitivity. Checks all voltages from 0 to 1,000 AC/DC, 500 milliamp, 500 microamp and plus and minus 20 decibels. **£5/19/6.** (Post 8/6.)

WALTHAM TRADING CO.

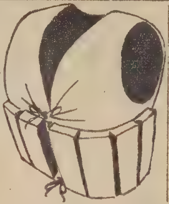
96 OXFORD ST., SYDNEY
243 RUNDLE ST., ADELAIDE
229 ELIZABETH ST., MELBOURNE
Mail Order to nearest office

MINIATURE FIELD GLASSES



Ideal for races, boating, opera, etc. Self-contained folding case with centre focus adjustment. **25/.** (Post 2/6.)

LIFE JACKETS



A must on any boating trip or beach holiday. Equip your family and crew with a lifejacket each. Large, medium and small sizes available, **33/6.** (Post 3/6.)

WATER BAGS

12in, **11/6;** 14in, **12/6;** 16in, **13/6.** (Post 3/6.)

WATER BOTTLES

With shoulder strap, **7/6.** (Post 2/6.)

BLANKETS

New woollen single bed, **38/6.** (5/- delivery to Rail)

Cape Ground Sheets

Combined ground sheet and rain cape. Ex-Army, perfect condition, **19/6.** (Post 3/6.)

RUCKSACKS

Large roomy rucksacks with two pockets, **59/6.** With three pockets, **69/6.** With 3 pockets and special lightweight aluminium supporting frame, **99/6.** (5/ delivery to rail.)

BAROMETER

Beautiful in appearance and mechanics. An attractive and useful gift and an asset to any room, **39/6** (Post 3/6.)

DEPTH GAUGE AND COMPASS

An invaluable instrument for any diver, or boat owner. Straps to the wrist like an ordinary watch. Reads to 200 ft. **£3/19/6.** (Post. 2/-.)

MAP MEASURERS

Deluxe model with map measurer one side and a compass on the other. Calibrates miles, kilometres and nautical miles direct from scale map, **19/6.** Standard model, less compass, **17/6.** (Post. 1/ both.)

CAR THERMOMETER

With powerful suction cup which sticks easily to windshield or dashboard. Farenheit scale. **12/6.** (Post. 2/6.)

NEW CAR AERIALS

Pioneer car aerials, side mount, **65/.** Cowl mount, **57/6.** (Post 3/6.)

FEELER GAUGES

Always carry a set of these Moore and Wright feeler gauges in the glove-box, **5/9.** (Post 6d.)

AUTO PLIER SET

Contains three pliers in plastic tool roll. Blunt-nosed and cutting pliers, **19/6.** (Post 2/6.)

GREASE GUN

As used by mechanics. Do all your own greasing and save money. Supplies 7,500lb pressure per square inch. **59/6.** (Post 3/6.)

CAR FAN MOTOR

6-volt DC motor, suitable for driving car fan, **35/.** (Post 4/6.)

MANIFOLD PRESSURE GAUGE

Reads 20mm vacuum. Checks fuel consumption to further engine efficiency, **22/6.** (Post 3/6.)

SPARK PLUG SUPPRESSORS

Checks car radio interference, **1/9 each.** (Post 6d.)

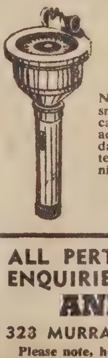
SPEED CALCULATOR

Blackwell Mk. IV. Suitable for car trials, etc, **25/.** (Post 2/6.)

GERMAN ARMY MARCHING COMPASS

Brand new sighting compass as issued to German Army. **25/-.** (Post., 2/6.)

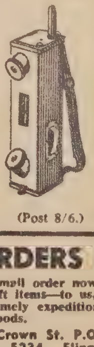
HAND BEARING COMPASS



Now at a price the small boat-owner can afford. Very accurate. Liquid damped with a battery-lit dial for night use.

£8/15/-
(Post 8/6.)

AMERICAN WALKIE TALKIE SETS



Just the thing for bushwalking clubs, surf lookouts. Light, compact and simple to operate with thumb switch,

£6/19/6 (Post 8/6.)

ALL PERTH ENQUIRIES TO ANDY'S

323 MURRAY ST., PERTH

Please note, however, that prices may be slightly higher in Perth, due to higher transport rates.

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Patrons are asked to mail order now for their Christmas gift items—to us, to ensure, efficient, timely expedition of those goods.

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MELBOURNE: Box 5234, Elizabeth St. P.O.
ADELAIDE. 243 Rundle St.

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- The major proportion of the world's requirements of resistors is produced by I.R.C. (U.S.A.) and its licencees throughout the world.

"G is for GRAVITY"

Today, through the world-wide interest in space flight, everyone knows about "G"—the force of gravity—a force to be contended with by men and machines.

I.R.C. BT Resistors (fixed composition) have been tested and proven at 20,000 G.

I.R.C. make sure that their resistors retain all their characteristics under the most arduous operating conditions.

I.R.C. AUSTRALIA

INTERNATIONAL RESISTANCE CO.
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THE CRESCENT, KINGSGROVE, N.S.W. 50-0111

ON SHORTWAVE — By ART CUSHEN

REGULAR BROADCAST FROM RABAUL

After testing for a month, the regular broadcasts of Radio Rabaul in New Britain, in the Territory of Papua New Guinea, are being heard on 4840 Kc, with 250 watts of power.

THE station is operated by the Administration of Papua, New Guinea; the address is P.O. Box 71, Rabaul, and verification is from the Station Manager, Mr R. W. Wilson. The transmission hours since it was officially opened on October 30, are Monday to Friday, 0755 to 1100 hours G.M.T., and on Saturday and Sunday the station broadcasts from 0840 to 1100. The transmitter is a TCA type of 250 watts, and the studio equipment also is all of Australian manufacture, including A.W.A. Consolette, S.T.C. microphones, and Ferrograph tape recorders.

The test broadcasts from Radio Rabaul were heard from as early as 0800 to after 1030, G.M.T., and the program consisted of recorded music with announcements in English and local language. The station identified as "You are listening to a test transmission from Radio Rabaul, New Guinea, on a frequency of 4840 kilocycles, in the 60-metre band, and on a power of 250 watts. These tests are being conducted by the administration of Papua-New Guinea." The station has long been projected to give radio coverage in this area, which does not seem to get good reception from Port Moresby, and the Postmaster-General's Department in Port Moresby plan to add to the facilities in that area to give further improvement.

LEOPOLDVILLE ON 1175 Kc.

SIGNALS from the Congo have been noted with broadcasts in English at 2130 G.M.T., when using the frequency of 11755 Kc. This transmission, beamed to Europe, is providing the best reception from the Congo for many months, and the station has a news bulletin in English from 2130 to 2145. The familiar drum beats are still used as an interval signal, and at 2145 G.M.T. the program is continued in French. The station identification is now: "You are listening to Leopoldville, broadcasting from the heart of Africa." The news is generally read by a woman announcer, and the signal is received without any interference on this channel. It seems that recent retiming of transmissions has enabled this area to enjoy much better reception.

BANGKOK ON 6315 Kc.

THE report on the reception of signals from Bangkok in Thailand was given in the October issue, and the station was reported as Radio SEATO. A letter from the SEATO organisation states the station is actually operated by the Thai Army. The experimental broadcasts are on 1525 Kc. on the broadcast band and on 6315 Kc. on shortwave. The station leaves the air at 1505 hours G.M.T. The slogan is actually Radio 20 (Radio Two-O), and the address for reports is Chief of Foreign Affairs Division, Public Relations Department, Bangkok, Thailand. The reports which went to SEATO have been forwarded to the station, according to SEATO Radio Officer Mr J. B. Orr.

MONTREAL BROADCASTS

RADIO Canada provides an excellent transmission each day for listeners in Australia and New Zealand, from 0830 to 0900 G.M.T. on 9630 Kc. News, commentaries, and music form the programs, but on Monday, except for the news bulletin, the session is devoted entirely to answering letters from listeners. Two 50 Kw. transmitters at Sackville, New Brunswick, are used and these are linked to the Montreal studios 600 miles away by landline. The new schedule for Radio Canada in the service to Europe and Africa is as follows:

1125-1615 G.M.T. on 15320, 17820 Kc., 1615-1630 on 15320 Kc., 1630-1945 on 11720, 15320 Kc., 1945-2000 on 11720 Kc., 2000-2130 on 9360 and 11720 Kc.

STATION ADDRESSES

FROM time to time readers write asking for station addresses, and we are always pleased to supply these, but in many instances the name of the station and the city in which it is located is sufficient. The World Radio Handbook gives this complete information, but for guidance of readers the larger stations are well enough known to exclude any street number or Post Office box. Such a question was recently asked by Ronald Smallecombe, of Adelaide, who asked about Radio Japan, Radio New Zealand, and Radio Moscow. The address of Radio Japan, Tokio, Japan, is sufficient; Radio New Zealand, Wellington; Radio Moscow, Moscow, U.S.S.R., are in each case adequate for postal delivery. When listeners hear some of the lower-powered stations which are privately owned, and in cities in which many stations operate, for instance, Sao Paulo, Brazil, then it would better to include the station slogan, callsign and full postal address to ensure delivery.

STRONG SIGNALS FROM GHANA

ONE of the strongest signals ever received from Africa is being heard at the moment, when the new Ghana Broadcasting System uses its 100 Kw. transmitter on 15285 Kc. during its broadcast to South and East Africa. The transmission is from 2000 to 2045 G.M.T. and another frequency 9545 Kc. is used to West Africa. The program includes news, commentary, Ghana newsreel and music. The sign-off announcement includes reference to the next transmission at 2130, when the service to West Africa is broadcast on 9545 and 6070 Kc. Signals are strong on 15285 Kc., which is heard well throughout the broadcast, but the alternate channel of 9545 Kc. has some interference from Warsaw using the same frequency.

SINPO SCALE

SEVERAL of our readers have asked about the SINPO scale, which is in almost universal use by broadcasting organisations. Many of the broadcasting stations on shortwave, which have an international audience, supply the listener from time to time with report forms which indicate in graph form the signal strength of the transmission, generally over a four-hour period for each day of the week. Such sheets in different form, have been issued by the B.B.C., Radio Canada, Radio Japan, Brussels and other stations, and all use the SINPO scale for signal and other factors to determine the strength and quality of reception.

Over the past years the RST code has been used and this refers to readability, strength and tone (the latter mainly for CW) and is rated 0 to 9, and 0-5, but these days is mostly used by the radio amateur.

The word SINPO stands for Signal, Interference, Noise, Propagation and Overall merit which are rated on an 0 to 5 basis.

Here are the various definitions of the signals from the Radio Canada graph:

SIGNAL (strength): 5—excellent, 4—good, 3—fair, 2—poor, 1—barely audible.

INTERFERENCE: 5—nil, 4—slight, 3—moderate, 2—severe, 1—extreme.

NOISE: 5—nil, 4—slight, 3—moderate, 2—severe, 1—extreme.

PROPAGATION (vagaries): 5—nil, 4—slight, 3—moderate, 2—severe, 1—extreme.

OVERALL RATING: 5—excellent, 4—good, 3—fair, 2—poor, 1—unusable.

A perfect signal is therefore 55555 and this would not occur on shortwave unless one was tuned to an almost local station. Our checking has found that Radio Australia and Radio Canada often are 10 to 30 dB over 9 on a signal meter, but fluctuate to R7 at times, and it would only be on a local broadcasting signal that the perfect transmission would be received. B.B.C. engineers, when this matter was mentioned recently, said they never expect to receive a perfect signal from overseas listeners, as the report covers an hour in each segment, and to remain at this level over such a period is unlikely.

AFRS SCHEDULE

AN almost completely new lineup of transmitters is now being used by the United States Armed Forces Radio and Television Service, in Los Angeles, California, for its broadcast to the Pacific, Japan and Alaska. The broadcasts are now carried as follows:

KCBR1, 17770 Kc., 0200-0700 G.M.T.

KCBR2, 21460 Kc., 2500-0315, 15210 Kc., 0400-0745, 5965 Kc. 0800-1500.

KCBR3, 17820 2300-0135, 11900 Kc. 0400-0745, 9560 Kc. 0800-1500.

KCBR4, 6040 Kc., 0600-1145, 15340 Kc. 1200-1500.

KCBR5, 11830 Kc. 0600-0800 G.M.T.

RADIO LA VELLA

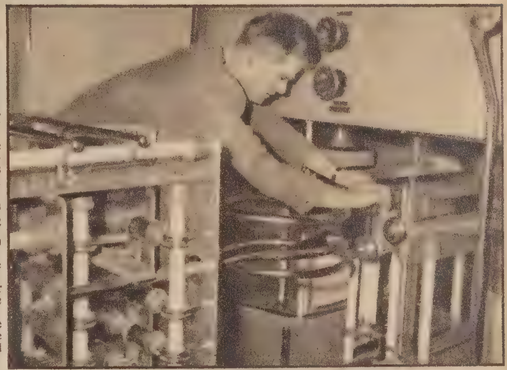
A NEW station identification is now heard on 6305 Kc. and this is from Andorra. The former Andorra Radio, which used this frequency, has switched its slogan to "Radio la Vella." La Vella is actually the town in which the station is located and the station has a session of news in French every 30 minutes in its transmission heard at 0730 G.M.T. Reception in this area has been possible at 0600 and music is featured with announcements in French. The station's address is P.O. Box 7, Andorra la Vella, Andorra. Though it uses only 1000 watts, its off band frequency enables reception at fair strength in the period from 0600 to after 0730 and in winter the period of listening is extended.

TUNIS IN ENGLISH

A STRONG signal is now being received from Radio Tunis, a relative newcomer to shortwave transmissions. Though we have frequently heard this 50 Kw. transmitter in local languages, we have now heard them at good strength with a session in English. The station is using 9635 Kc. from 2100 to 2200 hours G.M.T., and in this period has a multilanguage transmission for listeners in Europe. English news is presented from 2110 to 2120 G.M.T., generally with a woman announcer. The program includes Spanish, English, Italian, German and French. The transmission here suffers from some side interference from Vatican on 9640 Kc. Reports to Radio Tunis, Tunis, Tunisia, are verified with a folding card. The news is mainly on the Algerian questions and other items from Africa.

NEW TRANSMITTERS FOR BBC

THE B.B.C. recently embarked on a long-term plan for modernising and re-equipping the short-wave transmitting stations of its External Services, where most of the installations have been in operation since the early days of the war.



The picture shows the installation of a coupling truck, which plays a vital part in wavelength changing at the B.B.C. station at Rampisham in the West of England, where two new 100-kW transmitters are now in operation.

New features in the design of the transmitters include the use of vapour cooling instead of the conventional water cooling for the valves in the modulator and in the penultimate and final radio frequency stages. This system saves both plant and space.

The heat from the valves is transferred to water jackets surrounding them where it produces steam; this is carried by convection to an air-cooled condenser which re-converts it to water for return by gravity feed to the water jackets.

Rapid frequency changing, an essential requirement of short-wave broadcasting services, is made possible by providing two radio-frequency amplifiers for each transmitter. These amplifiers, contained in separate interlocked cabinets, are located on each side of a common modulator which can be switched to either. Thus while one amplifier is in use the other may be set up on a different frequency ready for the next scheduled change which can be made almost instantaneously.

The overall efficiency of the new transmitters is nearly twice that of the old equipment, thereby giving an appreciable economy in operating costs.

The new transmitters at Rampisham have been manufactured to B.B.C. specification by Marconi's Wireless Telegraph Company and the vapour-cooled valves have been made by the English Electric Valve Company Limited. The same manufacturers are providing similar new transmitters and valves for the B.B.C. Daventry station.

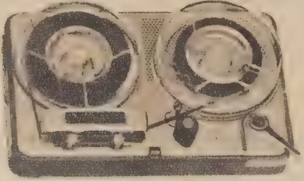
MASTER ELECTRICS PTY. LTD.

A WHOLLY OWNED
SUBSIDIARY OF
MOTOR SPARES
LTD.

TAPE RECORDERS

NIKKEI MODEL NC303

A versatile tape recorder for any recording use, music or speech or recording radio programs . . . A tuner is provided for this use . . . FEATURES . . . PLAYING TIME 60 minutes at 3¾ inches per second . . . REEL SIZE 5 inches . . . 5 step switch used for all controls Rewind, Stop, Play, Record and Radio . . . FREQUENCY RANGE 100 to 8000 CPS. . . . VALVES USED 6AU6, 6AV6, 6AR5, 6X4 . . . POWER SUPPLY 230 volts 50 CPS. AC. . . . DIMENSIONS 7 x 12 x 9 inches . . . WEIGHT 17lb. A really good recorder at a reasonable price—**£35/17/11 plus 12½% sales-tax £4/9/9, Total £40/7/8.**

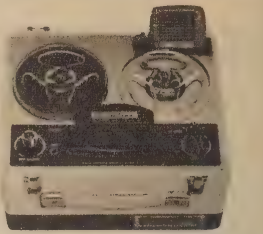


MEMOTAPE MODEL TC5

Fully transistorised precision built, battery operated, in metal case. TECHNICAL SPECIFICATIONS: FREQUENCY RESPONSE, 10db at 300 to 3000 CPS. TOTAL GAIN 70db at 1000 C/S. S/N RATIO, 35db at 1000 C/S. OUTPUT 100mW. INPUT IMPEDANCE 10,000 OHMS. OUTPUT IMPEDANCE, 10,000 ohms and 8 ohms. NON-FLUTTER 0.8 per cent at 3000 C/S. MOTOR CURRENT less than 120 ma. SPEED OF TAPE, 3¾ inches per second. REWIND TIME, 60 seconds. SIZE, 7½in x 4-5/8in x 2½in. WEIGHT, 2.2 lbs. BATTERIES, 9 Pen-light cells. PLAYING TIME, up to 2 x 16 minutes on 3-inch double play tape.

PRICE £30/19/-

plus sales tax,
12½ p.c., £3/17/5. **Total, £34/16/5.**



PORTATAPE MODEL TR101

An AC operated recorder in wooden case, Vinex covered. SPECIFICATIONS: DIMENSIONS 11¾ x 9⅞ x 7⅛ inches. . . . WEIGHT 16½lbs. . . . POWER SUPPLY 240 volts AC 50 CPS 65 watts . . . VALVES USED 2-6AU6, 1-6AR5, 1-5MK9 . . . POWER OUTPUT 1½ watts. . . . RECORDING TIME 1 hour at 3¾ inches per second with 5 inch tape (600ft.). . . . TAPE SPEED 3¾ inches per second or 7½ inches per second. . . . ACCESSORIES SUPPLIED, Crystal microphone, 5 inch recording tape and empty spool, radio, phone cord. 1 3¾ capstan and 1 7½ capstan. . . . This recorder is well priced and works very well.

PRICE £35/17/11

Plus 12½ per cent s. tax .. **£4/9/9**

£40/7/8

Q PLUS
CRYSTAL SET

Q PLUS CRYSTAL SETS

(as illustrated)

Cabinet is ivory bakelite size 5 inches x 3 inches x 3 inches with fixed detector, a really good job. Price less headphones and accessories **£2/13/6.**

Price with headphones, 100ft aerial wire and 2 insulators **£4/17/6.**

Q PLUS TRANSISTORISED CRYSTAL SET

gives extra volume and extended range, complete with phones, aerial, etc., **£6/19/6.**

100ft Outside Aerial Wire, waterproof type, **5/.**
50ft, **3/6.**

High impedance headphones, brand new and boxed, ideal, for **29/6 pr.**

High Impedance Crystal Earpiece, **10/** each.

SPECIAL NOTICE

All parcels sent Registered Post unless otherwise stated. Postage or Freight must be included with order.

HANSEN F.N. MULTIMETER

This meter can also be used to test valve emission and be used for many other tests.
1. Standard test leads.
The following accessories are supplied with each meter.
2. IG probe (non-interference).
3. High voltage probe (1400V D.C. 3500V A.C.).
4. High voltage probe, 28,000V.
5. R.F. lead probe.

Especially designed for Radio and Television servicing and ideal for Transistor Radio Servicing.

The sensitivity of this meter is 20.000 ohms per volt D.C. and 5,000 ohms per volt A.C.
Ranges are: D.C. Volts, 0-0.28, 1.4, 7, 35, 140, 350, 700.
A.C. Volts, 0-1.4, 7, 35, 140, 350, 700.
High Volts 0-1,400, 7,000, 28,000 D.C.; 0-3,500, 28.000 A.C.
D.C. M.A. 0-7, 140ma.
D.C. Microamps 0-50 microamps.
R.F. Volts, 0-14 RMS, 0-40 P.P.
D.B., minus 20 to plus 59.
Ohms 0-5,000, 500,000, 50 megohm.
Microfarads, 0-0.03, 0.6.
Henries, 0-5H, 500H.

PRICE ONLY £15/15/-

Plus 12½ per cent Sales Tax.

Total Price, £17/14/4, plus postage

★ SPECIALS ★

1. Extra special—just landed, a shipment of imported single ear pieces, magnetic type as used in all transistor sets. Complete with cord and plug. Two impedances available—8 ohm and 16 ohm. These have previously been sold at 12/6. Our new price, **5/9 ea.** Write for quote on quantities.
2. Silicon Diodes. Ideal for voltage doublers in TV sets, etc. Also can be used as a replacement rectifier in A.C. and battery portables. Will operate on any current up to 400 ma. Price, **11/6.**
3. Germanium Diodes. English made. Brand new and perfect. Ideal for use in crystal sets, transistor portables, etc. Only **3/6 ea.**
4. Illuminated screwdrivers. Metal body contains 2 long-life torch cells and globe floodlights work. Four screwdriver bits are supplied with each kit; 2 Phillips and 2 standard type. All parts in neat leather container. Reduced from 16/ to **12/6.**
5. Tech. Vacuum Tube Voltmeter, model PV58. Ideal for service on TV sets, transistor radios etc. It will measure D.C. voltage, A.C. voltage, ohms, R.F. and high voltages. Also has zero centre indication. Valves used 6AL5, 12 AU7. D.C. and A.C. voltages, 1.5, 5, 15, 50, 150, 500 and 1500. Ohms 0-100 1000,1000, 1 meg., 10 meg., 100 meg. High voltages up to 30,000 volts using HV20 probe. R.F. voltage up to 20 volt R.M.S. using RF 22 probe. Very solid construction in metal box 7 x 4¼ x 3½ inches. Weight 3½lb. This job is reduced from £19/10/ plus tax to **£15 plus 12½ p.c. tax—£16/17/6** plus freight. Extra for RF probe £2 plus 12½ p.c. tax—**£2/5/,** plus freight. Extra for HV probe £2/15/ plus £12½ p.c. tax—**£3/1/9,** plus freight.

547 ELIZABETH STREET, MELBOURNE — Phone FY0271

BRANCHES THROUGHOUT VICTORIA AND RIVERINA.

FLASHES FROM EVERYWHERE

HAMBURG station, Nordwest Deutcherrundfunk, has recently commenced to relay its VHF programs on shortwave, and a report from Europe lists the frequency as 6195 Kc. Reception is at 0600 and again at 1800 G.M.T.

PARIS is using the relatively low frequency of 3960 Kc. for its relay of the Paris local programs, which are also heard on 6175 Kc. The news in French is carried on 6175 and on 3965 Kc.

ATHENS, in French and English, is using a frequency of 17742 Kc. and has the French transmission at 1720 and English at 1730. The Swiss DX session reports that the station announces simultaneous transmission on 11720 Kc.

MELBOURNE has made some frequency changes when it introduced its summer schedule, the session for Asia is now on 15220 Kc. from 0559 to 1300 hours, G.M.T., moving from the old channel of 15180 Kc. The United Kingdom transmission is now broadcast 0814-0915, using 11710 and 9570 Kc. This is both a change of schedule and the use of an additional frequency. The English program to South-East Asia formerly on 15210 Kc. has moved to 15220 Kc., and is broadcast 2214-0015 G.M.T. The program of the A.B.C. home service in Melbourne on VLG15 has also been altered in frequency, being 15220 Kc. instead of 15210 Kc. for the broadcast from 2000-2200.

COLOGNE, with i's Deutche Welle transmissions gives good signals in this area on the new frequency of 6100 Kc. and sign-off is at 0558. This transmission is in German throughout and the call sign is DMQ6.

SEOUL, Korea, carries the programs of the United Nations Command on 6035 Kc. for the period 0900 to 1600 G.M.T.

TEHERAN, with broadcasts on Radio Iran, has changed its frequency of 9680 Kc. for the broadcast from 0745-1215 G.M.T, and now uses 9755 Kc. The station is now verifying all reports with a letter and copy of the English publication "Iran Today," which is sent to all listeners.

TUNISIA is broadcasting over Radio Tunis of 50 Kw. on 11972 Kc., from 0500-0800 and 1600-1900 hours G.M.T., also 0800-1600 on 17845 Kc., and from 1900-2100 on 6115 Kc. The transmission, in its service to Europe, mentioned elsewere on this page, is included in the period 2100-2315 hours when it uses 9635 Kc.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, N.Z. All times are G.M.T., add eight hours in West Australia, 10 hours in Eastern Australia and 12 hours in New Zealand to convert to local time.

TURKS ISLAND, in the West Indies, has a broadcast which enables reception of another new country. According to Radio Australia DX Session, the station has a session of news at 1600 G.M.T., except Sunday, on 4560 Kc. The broadcast includes shipping and local news items and reports on reception should be sent to the Superintendent, Radio VSI, Cable and Wireless, Grand Turks, Turks Island, West Indies.

AUSTRALIA'S transmission to the United Kingdom is now broadcast on 11710 and 9570 Kc. from 0815 to 0915 G.M.T. This new schedule means a retiming of the DX Session, which is now on the air at 0900 hours G.M.T. each Sunday.

KARACHI station of Radio Pakistan has good signals with news in English at 0800 to 0810 hours G.M.T. The transmissions are on two frequencies, 21590 and 17745 Kc., and in recent weeks the same frequencies have been on the air from 0500 hours, when they carry the cricket commentaries in the present tour of the English team to India and Pakistan.

MANILA'S fine music station, DZFE, on 1030 Kc. medium wave, has its programs carried on shortwave and good signals have been noted at 2330 G.M.T. when a news bulletin is broadcast. DZF3 on 15380 and DZ18 on 21500 Kc. provide the best signals.

HAITI station 4VEH at Cap Haitian is now transmitting on a daily basis (in the past the staiton was silent on Thursdays) and uses 6120, 9770 Kc. From 1100 to 1300 G.M.T. in English, 1645 to 1900 in French, 1900-2030 in English 2030-2100 in Chinese, 2100-2300 in Spanish, 2300-0100 in French, and from 0100 to 0400 the programs are in English.

GHANA. In addition to the service mentioned elsewhere on this page, Ghana is using 7295 and 17868 Kc. for a service from 1700 G.M.T., according to a Swiss report. A musical request program was broadcast at this time and at 1800 a news bulletin in English was presented. The report also states that Ghana has altered its highest frequency from 21545 to 21670 Kc.

OMDURMAN, with broadcasts from Khartoum, is listed as using 7200 Kc. for the period 1530 to 2400 G.M.T. The transmission is in Arabic and the channel is not a good one, severe interference from both Moscow and Bucharest being observed on the transmissions.

. . . FOR XMAS GIFTS & CAMPING GOODS SEE . . .

BUT MAIL ORDER NOW FOR CHRISTMAS

SURPLUS STORES
512A ELIZABETH ST. MELB. OPPOSITE THE VICTORIA MARKET

TELESCOPIC RIFLE SIGHT
Suitable gift for the man who likes shooting. Supplies 4 magnifications through blued lens. Has windage and elevation adjustment and clamps. **£6/15/-.** (Post 4 6.)

GREASE GUN
Do your own greasing at home and save money. Supplies 7,500lb pressure per square inch, **59/6.** (Post 7 6.)

VERNIER CALIPERS
Accurately measure inside and outside diameters and depth with vernier scale. Two models. **12/9** and **17/6.** (Post 2 6)

WHIP AERIALS
Suitable for fishing rods, wireless masts, car radio aerials, etc. Three screw-together sections total 12 feet in length. **22/6.** (5 delivery to rail.)

TAPPED TRANSFORMERS
230-Volt:
6—12—18—24—32 Volts. 2 amp., **52/6.**
6—12—18—24—32 Volts 3 amp., **59/6.**
6—12—18—24—32 Volts 6 amp., **75/-.**
(5′ delivery to rail.)

TELEPHONES
Ex-Army field phones Ideal as shop to store communication. Far cheaper than normal P.M.G. extensions — no yearly rentals, either. **£4/9/6.** (5′ delivery to rail.)

HAND BEARING COMPASS
Now at a price the small boat-owner can afford. Suitable for normal navigational purposes and for taking land bearings. Battery-lit dial. **£8/10/.** (Reg. post, 8′6.)

MAGNIFYING GLASSES
New! 20 magnification glass, ideal geologist's glass, **25/.**
New! Triple-lens glass, use lenses separately or combined, **9/6.** Folding packet glass, twin lens, supplies 8 magnification. **15/.** (Post 2 6.)

ARMY TOOL BOXES
Unused Army toolboxes with double hinged lid and leather carrying straps. Suitable for heavy tools—workshop or car, **12/6** (5 delivery to rail.)

WILLIS LEVEL
Invaluable instrument for farmers, builders, contractors, etc. Very accurate, suitable for grading, fencing, irrigation, plotting, etc., **£13/13/.** (5 delivery to rail.)

AMERICAN WALKIE TALKIE
Ideal sets for bushwalking clubs, surf clubs, etc. Easy to operate, light and compact to carry. **£6/19/6** each. (Post, 8′6.)

NEW! MODERN!
TELEVISION MICROSCOPE
The up-to-date way of microscopic study. The image lights up large and clear on a TV-type screen for your inspection. Focus is easily adjustable and slides are supplied. **45/.** (Post, 4 6.)

STUDENTS' MICROSCOPE
JUNIOR KIT: Contains 300 magnification microscope, scissors, tweezers and many other instruments in a wooden gift case, **34/6.** (Microscope without wooden case and extras, **25/**). 150 magnification microscope, **12/6.**
INTERMEDIATE MICROSCOPE: Single lens supplies 300 magnifications in three stages. Supplied with slides, in a polished wooden case, **£2/5/.**
SENIOR MODEL: Twin lens, triple turret, supplies 600 magnifications. Has built-in lighting for night work, **£6/19/6.** (Post, 5 6, all microscopes.)

STILL THE WORLD'S BEST GIFT
BINOCULARS
Always the most appreciated gift. Come in beautiful pigskin cases. All at the one low price.
7 x 50. 10 x 50. 12 x 50. 16 x 50. All **£14/17/6.**
Also 20 x 50 pair, as used by top racing commentators, etc, **£17/19/6.** (Post, 8 6.)

LIFE JACKETS
Take the anxiety from your holidays. Fit each member of your family or crew with a life-jacket. Small, medium or large, **33/9.** (Post, 3 6.)

ZIPPERED SLEEPING BAGS
Light, portable sleeping-bags, with side zipper for easy access to and from. **£4/12/6.** (Post 8 6.)

BRAND NEW BLANKETS
Brand new, unused Army blankets in grey, green, checks. Ideal as car rugs and single bed blankets. **38/6.** (5′ delivery to rail.)

6 OR 12-VOLT CAR BATTERY CHARGER
Yes! You can charge your own car battery in just 24 hours. Saves cost, risk of below-average job and the troublesome lugging of battery to garage and back. Works off household supply, **£7/15/-.** (5 delivery to rail.)

SANWA MULTIMETERS
SUPER SANWA MULTIMETER. Used for finding faults in garage equipment, household appliances, car wiring, etc. Sensitivity 2,000 ohms per volt. All voltages from 0 to 1,000 AC/DC. 0-500 micro and milliamp, plus and minus 20 decibels. **£5/19/6. MULTI TESTER:** As above sensitivity, 1,000 ohms per volt, **£3/19/6.** (Both post 8′6 reg.)

METERS

0-1 amp AC/DC .	**55/**
0-3 amp AC/DC .	**55/**
0-20 amp AC/DC .	**55/**
0-115 volt DC . . .	**55/**
0-30 volt AC DC .	**55/**
0-250 volt AC/DC .	**70/**

(Post 2/.)

SPANNERS
Socket sets with ratchet handle and "L" bar, in Metric (6 to 23) and S.A.E. (¼ to 15 16), **30/** per set. Post, 2 6.)
SPARK PLUG SPANNER: In 5 8 and 13 16, or Metric 16 and 21mm, **59/6.** (Post, 1 .)
RING SPANNERS: Set of five in Metric. **52/6.** Set of six in S.A.E., **57/6.** (Post, 2 6.)
Open End Whitworth, **27/6,** Metric, **32/6.** Open end set on card. Four-piece only, **8/11.** (Post, 2 6.)

RECORDING TAPE
1,200ft spools of twin-sided recording tape, on standard 7in plastic spools. **29/6.** (Post, 3 6.)

TELESCOPES
POCKET TELESCOPE, in pocket-sized pigskin case. Supplies 28 magnifications, **£3/19/6.** (Post, 3′6.)
RANGE TELESCOPE. Supplies 40 magnifications. Ideal for range marksmen, lookouts, etc. **£8/19/6.** (Post, 8 6.)
POWER TELESCOPE. Supplies 50 magnifications. Complete with tripod, **£9/19/6.** (Post, 8 6.)

DASHBOARD COMPASS
Sticks easily to windshield or dashboard with suction cup on adjustable bracket. Oil damped with built-in compensation box. **49′6.** (Post, 4 6.)

NAVIGATIONAL COMPASS
Excellent compass for small boat, liquid damped, gimbal-mounted for accuracy and double-chromed against rust. **£4/19/6.** (Post, 4′6.)

ACETATE SHEET
Ideal map covers, table tops, windshields, side curtains, etc. 50in x 32in. **32/6.** (Post, 3 6.)

R.A.A.F. SPOTLIGHT
The only good spotlight on the market under £2. Ideal for shooters—12-volt with thumb-operated switch, spare globe and flex, **39/6.** (5′ delivery to rail.)

PISTOL GRIP SPOTLIGHT
Ideal for car, boat or shooting. Available in 6 or 12 volt. Complete with flex and thumb-operated switch. **£4/6/-.** (Post, 6′.)

● MAIL ORDERS
Please send your Mail Orders to Surplus Stores, 512a Elizabeth Street, Melbourne, early for your Xmas gift items. They will be treated personally with speed and care.

THE ULTIMATE IN QUALITY

MODEL 85K

MODEL 77KD

MODEL 75K

MODEL 76K

TELEFUNKEN Tape Recorders

	85KL	77KD Full Stereo	76K	75K
Speeds	3¾, 7½ ips.	3¾, 1⅞ ips.	3¾, 1⅞ ips.	3¾, 1⅞ ips.
Frequency response	30-20000 at 7½ ips. 30-15000 at 3¾ ips.	40-16000 at 3¾ ips. 40- 9000 at 1⅞ ips.	30-16000 at 3¾ ips. 30- 9000 at 1⅞ ips.	40-16000 at 3¾ ips. 40- 9000 at 1⅞ ips.
No. of tracks	2	4	4	2
Special feature	6 W. push-pull output stage with 2 built-in wide range speakers.	Extra speaker built into the lid for full stereo reproduction Transcription from one track to the other.	Facility for listening to one track whilst recording on the other. Possibility of playing back 2 tracks simultaneously.	Facility for installing back spacer device for dictating purposes.
Maximum playing time	4 hrs. 12 min.	Monaural: 12 hrs. 40 min. Stereo: 6 hrs. 20 min.	12 hrs. 40 min.	6 hrs. 20 min.
Retail price complete with 1 reel of double play tape (2,400 ft.), microphone, empty reel and radio connection lead.	£220 0 0	£186 18 0 (without microphone)	£162 15 0	£141 15 0

A most comprehensive range of accessories (stereo microphone, foot pedal controls, extension speakers, etc.) is available for these machines. All models are suitable for use in synchronism with movie and automatic slide projectors.

Some of the many distributors throughout Australia:
Melbourne: Amalgamated Wireless (A'sia) Ltd.; F. J. Upton & Co. **Brisbane:** Amalgamated Wireless (A'sia) Ltd.; Music Masters Ltd. **Adelaide:** L. S. Wise Ltd. **Perth:** Amalgamated Wireless (A'sia) Ltd.: J. Katz & Co. **Hobart:** Amalgamated Wireless (A'sia) Ltd.

Details of other distributors also trade enquiries from: **W. C. Wedderspoon Pty. Ltd.**
193 Clarence St., Sydney. Phone: 29 6681

ANSWERS TO CORRESPONDENTS

A LEGITIMATE GROUCH OR NOT?

J. E. (Pascoe Vale, S.A.) says that he ordered, for £1, plus postage, a box of assorted resistors from one of our advertisers, on the understanding that they were from the stocks of an ex-TV manufacturer. On receipt, half the resistors in the box proved to be modern, useable types in the 20 p.c. tolerance range; the other half were older style resistors that belonged to the era before local TV manufacture started. He apparently feels that the goods were misrepresented.

A.: You have not specifically identified the firm or the advertisement concerned but, if it is the one we think you have in mind, we doubt that you can make much of a case. After identifying the TV manufacturer concerned, this particular advertisement offers a selection of resistors or capacitors at a figure, respectively of £4/10/ per 100 and £5/10/ per 100. Right at the bottom of the section, under a separate heading "Special Price," 100 resistors of mixed values are offered for £1. The special heading and the very much cheaper price are obvious enough indication that the £1 assortment is distinct from the description and details pertaining to the £4/10/ assortment.

Again, the fact that many of the resistors supplied are apparently of the older 1-watt pattern does not mean that they are useless; they might well be just as good as the latest patterns, except for the matter of size. In short, 50 modern resistors and 50 older types for £1 plus postage can hardly, in itself, be described as bad value. Whether they happen to meet your personal needs is quite another matter.

A.M. (Mackay, Qld.) sends in a clipping from a local paper indicating the difficulties of providing a telephone service in sparsely populated areas. He wonders whether the Citizens' Band type equipment would be the answer to this problem.

A.: Frankly we doubt whether it would be. Without knowing the district involved or the distances, it would appear that these are considerable and probably well outside the few miles range which can be expected from relatively low-powered Citizens' Band type equipment. We would imagine that, since the P.M.G. Department cannot assist with phone lines, they would be well disposed to issuing licenses for higher-powered equipment and at a frequency more suitable to your particular needs. In other words, the position may not be greatly different from what holds in inland areas. We gather from the clipping that the P.M.G. Department has already suggested the use of radiotelephone facilities and that little local interest had been shown in the proposals. Perchance the need is indicated for a bit of local education and organisation?

* * *

A.W. (Wahroonga, N.S.W.) asks a question about ratio detectors and then goes on to describe some of his experiments with fluorescent tubes operated from old radio power transformers.

A.: Your question about ratio detectors would be a good one for "Answer Tom." Frankly we doubt that there would be any point in publishing your experiments with fluorescent tubes and power transformers, since they can lead to no special conclusion other than, perhaps, that the whole idea is a rather "dicey" one.

* * *

C.R. of Largs Bay, South Australia, asks if it is possible to add the midget amplifier from the May 1961 issue to the crystal detector set of the February 1958 issue. He has tried to do so but without success.

A.: Well C.R., we have examined the circuit of both units and they would appear to be completely compatible. We can only suppose that you have made a mistake with your wiring and suggest you carefully check this again.

* * *

R.F. (Wabag, New Guinea), would like to see us publish a transistor amplifier circuit using something better than the usual run of small coupling transformers.

A.: We read your letter with interest, R.F. and understand some of your problems. There seems to be a small but definite interest in this kind of amplifier and there is a strong chance that we will be able to do something about it in the near future.

* * *

B.M.G. (Flinders Naval Depot, Vic.) writes to renew his subscription and at the same time to enquire about a general coverage communications receiver. He also asks if we have any information on the Eddystone communications receivers.

A.: Thank you for the subscription, B.M.G., which has been passed on to the appropriate department. To date we have not published a receiver design covering the full range of frequencies from 500 Kcs to 30 Mcs which would be suitable for communication purposes. The majority of such sets have been intended rather for use by the average short wave listener. Communication receivers have been described in the past but designed for amateur band coverage only. We have had several requests recently for a general coverage receiver and will bear it in mind for a future project.

* * *

T.C. (Walkerville, S.A.), asks if we could publish an amplifier along the lines of the "One Transistor Amplifier for Crystal Sets" of May 1961.

A.: As you will have noticed by this time, T.C., such an amplifier was described in the June issue. We hope this solves your problem.

RADIO, TELEVISION AND HOBBIES QUERY SERVICE

TO assist our readers, "Radio, Television and Hobbies" conducts a technical query service. Conditions governing this service are set out below:—

(1) Requests for copies of circuits or technical queries requiring an answer through the post must be accompanied by postal note or stamps to the value of TWO SHILLINGS. Queries not accompanied by a fee will be answered in rotation on these pages.

(2) For the 2/ fee, we will supply circuit data, as available, for up to three projects. The amount of data available varies , but in no case can it include information additional to that already published in the magazine. As a rule, requests for circuits will be answered more speedily if they are clearly identified and not complicated by questions requiring the attention of technical personnel.

(3) The technical query service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits.

(4) The Editor reserves the right to return query fees or to limit the scope of an individual reply, where it is felt that a partial answer will be better than none at all. Please note that the inclusion of an extra fee does NOT entitle correspondents to special consideration.

(5) In addition to the normal query service, chassis blueprints are available for most of our projects, showing the position of all holes and cutouts for metal-working but containing no details of wiring, etc. Apart from complicated projects like TV sets and oscilloscopes, most blueprints cost 5/ each. Original photographs of most projects are also available, from 5/ for a 6in x 8in glossy print; postage 9d extra.

(6) Letters should be addressed to the Technical Editor, "Radio, Television and Hobbies," Box 2728, G.P.O., Sydney.

(7) "Radio, Television and Hobbies" does not deal in radio components nor will we debate the relative merits of competitive products. Prices and specifications of merchandise must be obtained from our advertisers.

(8) Technical queries are not answered by telephone.

COMPLETE KIT FOR

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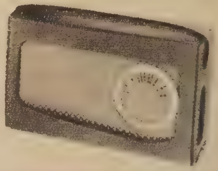
SCOOP PURCHASE OF MANUFACTURERS STOCK OF TRANSISTOR COMPONENTS ENABLES US TO SUPPLY THIS KIT AT NEARLY ½ PRICE



The complete kit of parts for the Transistor Six includes 6 transistors, printed circuit board, coil kit, Magnavox 4T speaker, Ferguson transformers, battery and all necessary parts to complete the set, including an attractive plastic covered case.

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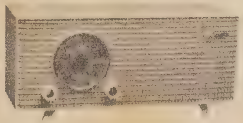

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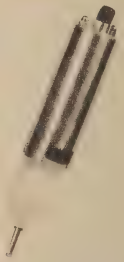

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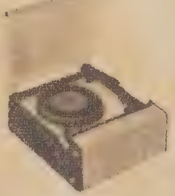

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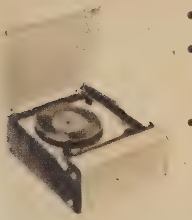

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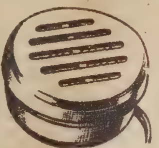
IT'S A REAL MINIATURE WITH ROLA UNIT



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10 pole 2-way silver plated contacts. 3/9

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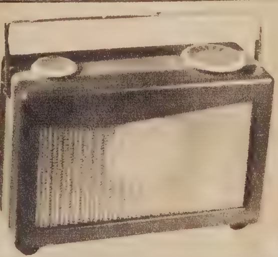

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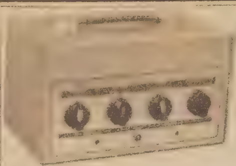

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The 25 Watt Amplifier uses 5 valves plus 2 rectifiers including two EF86 low noise valves as microphone preamplifier and two EL34 valves in push-pull output.
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3S4	10/	1Q5G	2/6	6C8G	5/	7C7	3/6	12A6	5/
1R5	10/6	1P5G	2/6	6SS7	8/6	78	7/6	EF50	2/6
1A7GT	9/6	1C7G	3/	6H6	2/6	6B6G VR55	5/	12SH7	5/
1D8GT	9/6							6K7G	4/6
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Please add postage on all valves.

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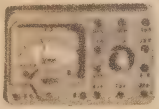

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SUPPLIED COMPLETE WITH TEST LEADS. RANGE 0-100,000 OHMS.

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500,000 ohms. 100,000 ohms 50,000 ohms. 5/6 ea. 50/ doz.	100,000 ohms. 500,000 ohms. 2/6 ea. 24/ doz.	200,000 ohms 100,000 ohms. 500,000 ohms. 5,000 ohms. 500 ohms W.W. 3/6 ea. 33/- doz.	500,000 ohms. 50,000 ohms. 2 meg. 1/9 ea. 16/ doz.	25 k. 250 k. 1 meg. 2 meg. 2/- each.

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TECHNICAL BOOK REVIEW

ANALOGUE AND DIGITAL COMPUTERS, Edited by M. G. Say, Ph.D., M.Sc., and published by George Newnes Limited, Tower House, Southampton Street, Strand, WC2, London. With 308 pages, 8½in x 5½in, with circuits, photographs and diagrams.

Hardly a book for beginners to electronics, this book could best be regarded as a basic text of electronic computing. As such it provides a thorough treatment of most branches of computing and will be of considerable use to final-year electrical engineering students and engineers.

As the title implies, the book treats both analogue and digital types of computer and stresses the differing fields of application of the two types.

In the analogue field it discusses the operation and applications of the analogue computer, its design and circuit details and its relationship to the servo-mechanism.

On the digital side the field is introduced with a discussion of number representation in digital circuits. Then follows a treatment of digital computer operation, circuit elements and computer sections, storage and storage devices, input and output equipment. The book ends with a short chapter on programming and general computer facts.

In short, the book would be a good one for the electronic engineer's shelf and a worthwhile basic text for the advanced student. A bit too advanced for the casual reader, though.

Our copy was from the Technical Book and Magazine Company, of 295-299 Swanston Street, Melbourne, and the price quoted was 72/ (post and packing 2/3). Copies should be available very shortly.—(J.R.)

* * *

HOW TO LOCATE AND ELIMINATE RADIO AND TV INTERFERENCE, by Fred D. Rowe. Second edition, soft cover, 168 pages, 8½in by 5½in, of text matter, diagrams and photographs. Published by John F. Rider, Inc., of 116 W 14th Street, New York.

With the introduction of TV to this country, the problem of locating and eliminating man-made interference has become even more important than it was in the days of radio only. While the average listener may tolerate a certain amount of noise with his favourite "soap opera," his patience is soon exhausted when this same noise becomes visual and interferes with a favourite TV program.

For the long-suffering TV technician, who has to contend with customers' complaints of interference, this new Rider publication should prove to be an invaluable aid.

The various chapters cover the subjects of basic interference sources and sounds, interference locating equipment, electrical equipment and appliances as noise sources, power line interference, noise filters, fluorescent and filament lamp interference, TV suppression for transmitters, eliminating interference at the receiver and a chapter on typical questions and answers about interference. This last is most useful, as it covers in brief most of the problems likely to be encountered.

A final chapter on F.C.C. rules and regulations is unlikely to be of much use to the Australian serviceman.

Our copy came direct from the publisher, John F. Rider Inc., but copies should be available from local booksellers in due course.—K.W.J.

* * *

TRANSISTORS—How to test them and build All-Transistor Test Equipment. Gernsback Library Book No. 94, published by the Gernsback Library, Inc. Soft covers, 8½in x 5½in, 95 pages, with photographs, diagrams, circuits.

Designed for the technician, laboratory worker and amateur, this book is essentially a practical guide to transistor testing and test instruments.

In the initial section of the book, devoted to transistor testing, four practical designs are presented—two for power types and two for low-power types. All the units presented are simple in design and should present few difficulties for the majority of constructors. Most of the parts used have direct equivalents available locally, which makes the book quite compatible to the Australian scene.

The second section of the book describes the construction and operation of a Wein-bridge harmonic distortion meter, a "noise squirter," a signal tracer, a TV Bar Generator, a signal generator, an oscillator, a C.R.O. calibrator, a small HV power supply and a direct-reading audio frequency meter.

Although the constructional details given are not of the "to the left of the valve socket is a 4-lug tagstrip . . ." variety, sufficient is given to allow most folk to build the projects with ease. For someone interested in the practical aspects of transistor test equipment, the book should thus prove very interesting.

Our copy came from Electronics Publications (Australia), of 11 Cadow Street, Pvmble, N.S.W. The price quoted was 20/. (J.R.)

* * *

AUDIO FREQUENCY ENGINEERING, by E. Hayden Jones, B.Sc., A.M.I.E.E., A.M.Brit.I.R.E. Published by Chatto and Windus Ltd., London. Soft covers, 8½in x 5½in, 241 pages. With circuits, diagrams.

Intended as an audio textbook for later-year and post-graduate students, this book deals competently with most phases of audio engineering.

Initial chapters deal with essential mathematics (vectors, complex variables, etc.), acoustic wave theory, sources of sound, and hearing and speech mechanisms. Characteristics of speech, music and noise are then treated, with further chapters on architectural acoustics, audio measurements, microphones, receivers and recording processes (magnetic, disc and film).

As one would expect, the subject is dealt with from an engineering viewpoint and thus enters into a good deal of mathematics and physical theory. Thus, while it is an ideal book for the student or engineer, it would be of little use to the casual reader or the average hobbyist.

Our copy (an advance proof) came from The Technical Book and Magazine Company, of 295-299 Swanston Street, Melbourne. The approximate local price was quoted at 55/.—(J.R.)

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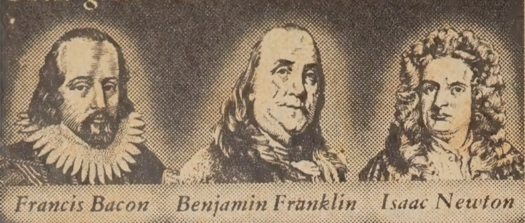
These great minds were Rosicrucians . . .



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)RESSURE SPRAYS

(Continued from Page 14)

an through a small orifice at ordinary emperatures. Stage one is the metering of the correct quantity of product into he can. The air in the can is then removed.

Stage two is the sealing of the can and urther removal of the air.

Stage three is the metering of the propellant through the valve and further emoval of air. Air is removed in several different ways, each of which is reated to the particular stage.

The low temperature method is very ast and is mostly used for present-day ommercial products. It is done by achinery which can fill about 120 cans er minute.

From the above description of the odern pressurised dispenser it will be een that there is a good deal more to eir production than meets the eye.

It will also be realised that for many urposes the dispenser has some ecoomic advantages because of the completeness of the atomisation of the prouct. In view of the fact that the prouct forms such a small portion of the ixture in the can, it is possible to get ffective results from a smaller quantity f product because of the complete tomisation and the spreading of the roduct over a larger area.

VHF ANTENNAS

(Continued from Page 23)

etal antenna reflectors have automatic cks under the metal to smooth disrted surfaces.

"This is effective, but is an unnecessary omplication in antenna reflectors 30 et or less in diameter," said Rheinhold. Reinforced fibreglass is strong enough hold its shape in these sizes and is ry resistant to temperature change disrtion."

In the Boeing design the laminated breglass is formed and cured on a manel or pattern and then filled with polyethane foam. The foam, commonly ed as a building insulating material, ves the reflector rigidity without excess eight.

Since fibreglass is a non-reflector, the rface of the dish must be coated with radio-wave reflecting material. This n be done by painting the surface with metallic paint or by covering it with ht bonded metal foil.

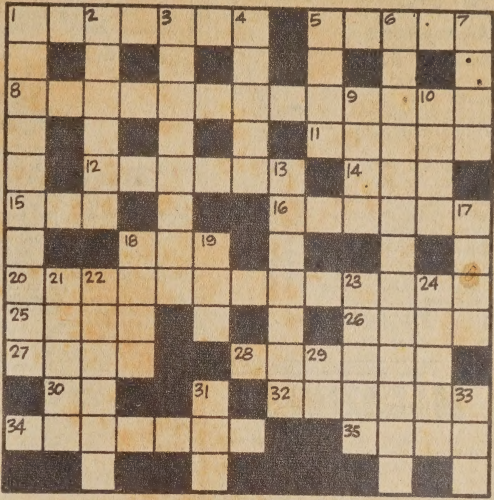
Raymond Glaser, manager of the anna department, feels that the new rector has special application in radio escopes, radiometry and radar track.

"The fine focus of an antenna with h a reflector would be especially usein radio and television transmission," said. "Because most of the intensity the original signal is maintained by the lector, the range of electronic comnications could be increased."

Boeing is presently describing these other potential applications of the v reflector to representatives of intry and government. The reflectors available in either paraboloidal or nplex-curvature sections.

(Boeing Magazine)

THE R., TV & H. CROSSWORD No. 88



ACROSS

1. Connecting all metal parts together electrically.
5. Snake.
8. Periodic voltage variation in a DC circuit.
11. The lot.
12. Man's name.
14. Expose hemp.
15. Broadcast.
16. Compounds containing oxygen.
18. Exclamation.
20. It acts to resist the sudden rise of current in a circuit.
25. Lake.
26. County in England.
27. Divided points.
28. Entertainers.
30. Stands for a sailor.
32. Gained as clear profit.
34. Place of entertainment.
35. Drunkards.

DOWN

1. The effect caused by slight fluctuations in the rate at which a material becomes magnetised.
2. He is associated with logarithms.
3. Gilbert and Sullivan opera.
4. Donates.
5. The unit of electromotive force.
6. Type of signal rectifier
7. Holds hook-up wire.
9. Japanese temple gateway.
10. Entrance.
13. Strain produced by twisting.
17. Separate.
18. Eras.
19. Electrical discharge.
21. First name of a humble Dickens character.
22. Strengthened.
23. Satirical sketches.
24. Sudden attack.
29. Pronoun.
31. Attempt.
33. Decoration.

OFF THE RECORD

(Continued from Page 99)

sult of two years of work by Darrell Bailey, formerly associate Musical Director of the N.S.W. Department of Education.

Side 1 is devoted to an excellent presentation of Israeli songs, sung in the original language and performed in traditional style. Though knowing very little of the background, I imagine that this would be of large sectional interest.

Side 2 is devoted to popular music of many lands, beginning with "Waltzing Matilda"—one of the less successful items on the program.

Nevertheless, for children in the 10-12 years age group, this is very good singing and should have an interest on this score alone, for those concerned with junior choral activities.

The recording itself is of excellent quality, being largely the responsibility of Robert Iredale, well known in Sydney audio circles.

Last month's solution

D	I	E	L	E	C	T	R	I	C	■	■	P
E	R	A	■	■	H	I	E	■	■	M	■	H
C	E	R	T	A	I	N	T	Y	■	E	T	A
I	■	S	A	W	N	■	S	E	R	I	E	S
B	I	P	O	L	A	R	■	A	I	S	L	E
E	E	L	S	■	■	E	A	R	■	S	E	■
L	■	I	■	S	C	A	N	N	I	N	G	■
S	■	T	■	P	A	C	T	■	■	E	R	■
■	S	T	R	I	C	T	■	B	O	R	A	X
A	M	I	■	L	H	A	S	A	■	■	P	■
L	E	N	G	L	E	N	■	N	I	G	H	T
L	A	G	■	E	■	C	■	F	■	■	■	O
■	R	■	E	D	G	E	E	F	F	E	C	T

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